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THE  
FARMER'S  
COMPANION;

BEING  
A COMPLETE SYSTEM  
OF  
*MODERN HUSBANDRY:*

INCLUDING THE  
LATEST IMPROVEMENTS AND DISCOVERIES,  
IN THEORY AND PRACTICE.

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ILLUSTRATED BY NUMEROUS ENGRAVINGS.

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SECOND EDITION.

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IN TWO VOLUMES.

VOL. II.

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LONDON:

PRINTED FOR SHERWOOD, NEELY, AND JONES,  
PATERNOSTER-ROW;

AND TO BE HAD OF ALL BOOKSELLERS.

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1813.







# THE FARMER'S COMPANION.

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## PART THE THIRD.

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### TILLAGE, PREPARATION, AND MANAGEMENT OF ARABLE LAND.

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#### SECTION XI.

*Cultivation of Arable Land.—Methods of bringing into a State for Cropping.*

IN explaining the methods of management that are necessary in the cultivation of arable lands, in order to afford a suitable state of soil and nourishment for the growth of grain or other crops, it will be proper to consider them as relating to grounds that have not yet been brought under the plough, and such as have been already in the state of tillage.

*Removing Obstructions to Tillage.*—In the first, which are of very different descriptions, as rocky and other rough stony lands, wooded grounds, whether of the waste or other sorts, and those of the morass or other watery kinds, there are frequently various operations to be performed; such as the removing of stones, the eradicating of wood, both of the tree and shrub kind, the destruction of different sorts of plants of the aquatic and other denominations, and the removal of such degrees of wetness as may be injurious, before the business of ploughing or loosening the mould of the soil can be properly carried on. The stones that oppose obstruction, in this view, are principally either such as are met with in a loose state in the ground on its being ploughed, or such as are fixed in the soil, and incapable of being removed without much labour and difficulty. Some of these last are often of such a size as to present themselves upon the surface, and cause much land to be lost, by their not permitting the plough to come near them\*. Those which are concealed below the

\* They are termed *sit-fast* stones in some countries.



surface are, however, the most detrimental, as the implements are frequently destroyed, and much inconvenience experienced from them, before they can be perceived by the ploughman, though he may be perfectly attentive to the circumstance.

In such soils as contain no concealed stones of the rocky kind, as is the case in most of the alluvial and deep ones, if any inconvenience be sustained by the small ones that appear on the surface after harrowing, as may be the case at the time of their being sown with artificial grasses, or laid down to permanent grass, from the obstruction that may be given to the scythe, in such instances they may be picked off by the hand before rolling; or forcing them into the soil by heavy rolling alone, may occasionally be sufficient. When the former practice is adopted, they should not, however, as is the custom in many districts, be collected into heaps, or laid all along in the furrows; as in these ways they are afterwards liable to afford much obstruction, or to become again dispersed over the land. They ought always to be completely removed: the best season for doing which is, when the land is in summer tillage; as under such circumstances the business can be performed with the greatest convenience, and in the most effectual manner. In lands that are of the more wet kinds, they may, however, be collected into heaps of rather a large size, in order to be taken away afterwards during a dry season. The business of picking the stones is mostly performed by women and children, and the lands are cleared in this way with much greater expedition than can easily be supposed. Though an instance or two has been mentioned in which injury was supposed to have been sustained by the removal of the small stones from the ground, from the great evaporation of moisture that must necessarily take place, and the want of heat and shelter for the crops during the early stages of their growth, it is probable that much less inconvenience will be suffered in this way, than from the obstruction constantly afforded by the stones in the tillage of the land, and the loss caused by the great extent of surface which they occupy in many cases where they are numerous.

Where the stones are fast in the ground, of a large size, and appear above the surface of the land, the best practice is to dig them completely out of the earth after they have been blown to pieces by means of gun-powder; but if they be small, it will be unnecessary to blast them, as they may be raised, after being dug round, without that expense, by splitting them by means of wedges, or breaking them by large heavy hammers, and then conveying them off the land in some kind of low strong carriage\*. In clearing fields of large stones, a machine has lately been recommended, by which the heavy expense of boring and powder, with the trouble and danger of blasting, is not only saved, but the labour of loading them considerably lessened; three men, by means of it, being capable of raising stones to the proper height with more ease, expedition and safety, than ten in the common method. It is formed in the man-

\* A small portion of quick-lime in fine powder, mixed with gun-powder, is said to have been found to lessen the expense of that article in blasting stones.



ner of a triangle, and has much resemblance to that employed by wood-cutters in weighing bark. The method of sinking large pits close to the stones for concealing them in, is an expedient that ought but seldom to be adopted, on account of the danger that attends it, and the total loss of the stone. But where the stones are principally concealed below the surface, it will be necessary to discover their situation, either by going over the land with some sort of sharp instrument that can be readily thrust down into the ground, or to mark their situations during the time of ploughing, and afterwards to remove them by digging. In some cases, as where the stones are extremely numerous and the price of labour cheap, it may be a more advantageous and economical method to prepare the land by means of the spade than the plough.

In all cases, land should be as much as possible cleared from such stones as retard or prevent the operation of the plough, before the business of tillage be undertaken; as, without due attention in this respect, considerable loss may be sustained by the breaking of implements, and the great delay that must take place in the work. Besides, in many situations and circumstances, there may be great inducements to have this sort of work performed; as, where hollow or under draining becomes necessary, the rounder sorts of stones may be beneficially employed in filling them, while those that are of a larger and more flat form may be made use of in the construction of offices or other buildings, and sometimes even for the purpose of fences. As this work is frequently attended with a heavy expense, it may be proper, where there are no leases, or they are of short duration, to have it undertaken jointly between the land proprietor and the farmer; the former being at the expense of blasting the stones, and the latter at that of their removal from the ground.

It has been remarked by a late writer, that in situations where large surface-stones can be turned to any useful purpose, the most rugged lands may be reclaimed with profit. Vast improvements of this sort have been made in the more northern parts of the island. The surface of such lands should afterwards be rendered as level as possible, care being taken, in performing the business, to preserve the best parts of the soil upon the superficies of the ground. Where large stones are concealed in the soil, which is the case in many parts of this country as well as Scotland, the most effectual plan of bringing them into a state of cultivation is asserted to be that of digging the whole of the land over to the requisite depth, as from one to two feet, depositing such of the stones as are not wanted for the purposes of building, fencing, repairing roads, draining, or other similar purposes, in deep hollows, pits, or other places, in order to assist in adapting the surface to the processes of tillage, or burying them with the worst parts of the earthy substances so as to form the subsoil, to be covered with the better materials removed in the operation, and by that means rendering it the most suitable for the practice of husbandry. The expense in these cases must be different according to circumstances, as from five to twenty pounds the acre. In mountainous situations, where from the nature of the stones and the climate the lands cannot be cleared for the purposes of tillage, the object should



be to remove those on the surface, in the same manner as above, so as that the whole may be fit for the growth of herbage.

In the clearing of lands from wood, different methods must be pursued, according to the nature of the wood with which they are covered. Where there are large trees of the timber kind, they should be completely grubbed up at a proper season of the year, care being taken that the roots be as much as possible removed. In eradicating such trees as have their roots penetrating downwards to some depth, as the oak, it may frequently be unnecessary, after the earth has been well removed from about them, to cut more than a few of the strongest lateral roots, the rest giving way by pulling at the top of the tree by means of a rope. But in such as have their roots shooting laterally near to the surface of the ground, as the elm, the roots must be almost wholly removed before they can be got up, and the business of ploughing be properly carried on. In cases of this sort, trenching by means of the spade, and forcing the roots up by a pick-axe, is recommended by some as the most effectual method; as in this way the roots are not merely removed, but the land put into the most convenient form for future cultivation. Where the roots of this sort are not in too great a state of decay, they may in many cases be readily removed by blowing them to pieces with gunpowder, by means of a proper apparatus for the purpose, which has been lately invented and recommended by Mr. Knight, ironmonger, Foster-Lane, Cheapside, London. Besides, when such portions of brushwood as may have been collected upon the surface of the land have been cut at the same time and consumed with the roots, some advantage may be gained in the way of manure, by spreading the ashes over the ground, and in some measure repay the additional expense that may have been incurred by the trenching. But in most cases, especially where the price of labour is high, we believe the business may be well enough accomplished by a strong plough with a suitable strength of team. After the trees, and as many of the roots of these shrubby plants as possible, have been removed during the time of the first ploughing up, the land may be sown with some sort of crop to which it may be the best adapted; and, after that has been taken off, be more completely cleared by repeated ploughings and harrowings, both lengthways and across the ridges, until the whole are extirpated. Or, when there is time, this may be done before any crop is put into the soil; which in many cases is a method to be preferred, as a good or full crop of any kind can seldom be expected till the ground has been perfectly freed from the roots of such trees and plants, on account of their more increased tendency, under such circumstances, to shoot up and vegetate afresh, and thereby injure it by the great space which they occupy, and the shade they produce; or, where their roots decay in the soil, by rendering it too light and open for the growth of most sorts of crops.

As different sorts of plants prefer different soils—the broom and bramble kind being found to grow with the greatest luxuriance on such as are of the more dry and sandy or gravelly qualities; the furze, on such as are dry, but which approach the nature of loam or clay; the thorn kinds, on those that are of a more mellow and less adhe-



sive description; and the low willows and alder on such as possess considerable degrees of moisture — it may be possible in many instances to derive great advantages in the removal of such obstructions to cultivation, by the application of such manures or other substances as may produce changes and alterations in the textures or general nature of the soils, and thus lessen their tendency to the production of such plants. In this view the application of clayey marle, or composts with peat-earth and lime, or loamy and clayey earths and lime, farm-yard manure, or composts made with it and mould, night-soil with good vegetable earth, sand and various other materials, according to the circumstances of the soil, the nature of the plants, and the convenience of the substances in respect to their application, may be proper. The removal of superficial moisture may also be useful in the same way in many cases.

In cases where such sorts of shrubs have become of considerable size, the general method of proceeding is to cut them down as close as possible to the surface of the ground, and afterwards to dig round them, and grub them up in the manner that the larger trees are cleared. With furze it is sometimes customary to set fire to them, in order to uncover their stems before any attempt is made to grub them up; but this is a practice that ought to be as much as possible avoided, from the danger that may attend it, and the loss of the furze, as well as a large portion of the valuable vegetable matter accumulated in many cases beneath them.

As it has been found from experience, that such lands as have been attempted to be cleared from bushy plants of this kind, especially those of broom and furze, are extremely liable from the roots and seeds that may be left in the soil, to have them coming up again in great abundance after they have been laid down to grass; it should be a practice to keep lands that are much disposed to their production, in the state of tillage for such a length of time as may be fully sufficient, by the various means of cultivation, and the application and blending of lime and other suitable manures with them, to have them as completely removed as possible; and, when they are restored to the state of grass, to have them pastured, as much as can be conveniently done, with sheep. It has indeed been observed by an intelligent writer, that if whins, or shrubs of any kind, are once grubbed up in the way that has been described, sheep being then admitted to pasture, would prevent them from ever growing again from the small roots left in the ground. But still more would this experiment, he conceives, be likely to prove successful, if the ground were completely fallowed, and every root that appeared removed. The land, being then well limed and manured, might be subjected to a course of cropping, and be sown down with grass seeds without a crop. As soon as the grass afforded a safe bite, he would admit sheep, and not wait for a crop of hay. It is presumed that sheep would destroy the tender shoot of every shrub as fast as it rose, and keep the ground ever after clear. If, however, this practice should not be sufficient to prevent the shrubs from sending up fresh shoots, the best method would be to have again immediate recourse to the plough, and such other means as have been recommended above, as



by delay the plants may become too strong to be turned under by the plough.

Heath being a sort of plant that for the most part infests those soils that are of a moory nature, and in which there is but a small proportion of vegetable matter, on account of there being few leaves or other vegetable products, except the heath itself, to be converted into mould; the recrements of this plant are not found to afford improvement to the soil on which it grows, in the way that is experienced to take place from the decay of many other more saccharine, mucilaginous, and juicy plants. Hence it probably is that the heathy soils are mostly so poor and unfriendly to the growth of useful crops, whether of the grain, leguminous, or grass kinds. In bringing this sort of land into the state of tillage—as it has been found from repeated trials, that where the heath is turned down without being removed or completely destroyed, it keeps the furrow slices from coming into intimate contact with each other, so as that, by confining and retaining a due degree of moisture, the decomposition and decay of the heath may be quickly effected, and the soil of course in too open and loose a state for the growth of almost any crop—it should be cut as close to the surface of the ground as it can be conveniently done; or, what is probably a better practice, removed, by paring off a very thin slice of the surface ground with it, and then either consumed by means of fire, or applied to such other purposes as may be necessary. In the dry spring months it is indeed capable, in many cases, where it grows high and of considerable closeness, of being burned without the labour and expense of either of these operations. But in all cases where fire is employed, as the staple of soils of this kind is seldom deep, care should be taken that the combustion be not carried to too great a height, so as to prove injurious by consuming the small portion of vegetable material that may be present\*. The operation of cutting the heath may be most conveniently performed by an implement of the scythe kind, only made much shorter and of greater strength, so as not to give way or break by the stiffness of the stems of the plants.

The heath having been removed in some of these ways, lime in its caustic or most active state is to be applied in large proportions, either over the whole of the surface before the ground is ploughed, or upon the soil when turned up. The former method is, however, to be preferred, as coming more intimately in contact with the plants, where lime is scarce, and cannot be laid on in large quantities; but where it is plentiful, the employing it in both ways might be more beneficial, by its thus tending more readily to the destruction of the roots as well as the stems of the plants. Where it can be procured, lime should, however, always be put on in large proportions on first bringing heathy or moory soils into the state of cultivation, as little savings in this respect in the first instance may often prove highly disadvantageous in the end. It has been observed by an able writer, that experience has proved that the addition of lime to the ashes of the pared surface operates greatly more beneficially than if spread in

\* See section on Paring and Burning.



any other manner; and that the larger the quantity, and probably the greater the proportional effect; that is, six chaldrons an acre will do more than twice the good of three chaldrons; the chemical effect both in neutralising the acids found in all these soils, and also in destroying the roots left of the spontaneous growth, depending in some measure on the effect taking place suddenly. It has been known, that eight chaldrons an acre, laid on at once, have converted a moor into meadow worth twenty-five shillings an acre; but the same moor, under one chaldron per acre per annum for eight years, has not been worth seven shillings and sixpence an acre. The effect of lime on all soils long in cultivation, is, he thinks, problematical, and does not answer the expense in one case in ten; but in new moor lands the effect is prodigious, and hardly credible: laid on ling mountains without tillage, without paring, or other operation than merely cutting the ling and spreading the lime, such moors have been changed from one shilling to twenty shillings per acre; but the quantity has been fifteen or twenty chaldrons per acre. The application must, however, always be regulated by the circumstances of the case. Where the expense per acre is forty or fifty shillings, the improvement will ultimately come high. And in order that the calcareous matter may be as intimately as possible blended with the particles of the soil, and thereby exert its effects most extensively, it should be applied over the land in the most perfect state of pulverisation, and as equally as it is possible to spread it out. Where the lime is applied with sufficient attention to these circumstances, it generally destroys the heath in a short time, probably in some measure by its powers of attracting moisture from the soils, and combining with the acid astringent juices of the plant, and rendering them incapable of affording it that kind of support which is requisite for its healthy growth, as well as by the alteration of texture that is produced in the land, and the caustic destructive action that may take place in consequence of its coming into contact with the roots in that state. After the lime has been applied, especially where the surface has been pared off and consumed by fire, the ploughing should only be slight, so as to blend it and the ashes with the soil, but not to place them at a great depth below the surface.

Where heathy or moory land has a higher degree of surface wetness, and is not so much overrun with the plant as to prevent its being employed as pasture, it may sometimes be brought into cultivation by merely removing the superabundant moisture by proper drains, burning the heath in the spring months when suitably dry, and afterwards pasturing it closely with sheep so as to keep it from seeding; as in this way, in time, it in some cases becomes wholly removed.

When this sort of ground has been broken down and pulverised as much as possible by the operations of ploughing and harrowing, it should always, where not too stiff, be sown with some sort of close, luxuriant, green crop, such as turnips, peas, and tares, that may be fed off by sheep; but where it has a sour quality, and is more stiff, clayey, and adhesive, those plants that strike more deeply into the soil, as beans, Swedish turnips, buck-wheat, rye, and oats of the gray kind. In many cases, too, rape, peas, clover, and vetches, will



succeed in a very beneficial manner. But as the principal intention, in most cases of breaking up this sort of land, is that of bringing it in a cheap and expeditious manner to a suitable condition after a grain crop or two for growing grass, the green-crops, of whatever description they may be, should be consumed by animals upon the ground, especially where the soil is such as to admit them without injury ; as in this method a high degree of fertilisation and improvement may speedily be obtained at little or no expense, from the great benefit the animals receive. If it can be conveniently done, two or more of this sort of crops may be consumed on the land in the same season, with still more beneficial consequences. Where the soil is too wet, stiff, and poachy, to admit of this practice, the crops may be drawn, or cut, and converted to the feeding of cattle in the house.

There is another description of land, which approaches in some degree to the nature of the above, that in bringing into tillage requires the coarse plants and herbage that it is naturally disposed to produce, to be extirpated and removed, as well as the hills and other inequalities that are sometimes present, levelled down and destroyed, before the plough can be properly employed upon it. This is that which, from its moisture, is naturally subject to the growth of rushes and other coarse aquatic plants, and that on which ant, mole, or other sorts of hills have been from long inattention and neglect suffered to accumulate to a large size, to become numerous, and to be covered with a tough sward. In cases of breaking up this kind of coarse grass land for the purpose of tillage, much may be effected, where they are very wet, by first forming such concealed or other kinds of drains as may be necessary according to circumstances for carrying away as much of their moisture as possible ; as by this means the tendency to throw up crops of these coarse plants may be greatly lessened, while at the same time the land is rendered more proper for the growth of most sorts of grain, or even green root-crops. After this has been as much as possible accomplished, paring and burning may frequently be most beneficially employed ; as by these operations the whole of the coarse vegetable products are at once completely reduced and destroyed, while a slight portion of manure is added in the ashes, and the ground is made ready for being ploughed, and the seed being introduced, in the shortest space of time possible ; whereas, when the sward is turned down after the coarse plants only have been removed, a considerable length of time is required before it becomes sufficiently rotted down and reduced by putrefaction, for the bearing of good and useful grain or root crops. There are other views in which this practice may be useful ; as by the more effectual pulverisation and aëration of the soil that is produced, which is of great utility in such land, as well as by the more complete destruction of those insects that are so numerous and often so injurious to crops sown on these grounds \*. But instead of the practice of paring and burning, it has been suggested by a late writer as more advantageous, after the turf is cut from the surface of coarse land, which is meant to be reclaimed, to collect it all into heaps in different parts of the



field, and make it up into compost with lime. The turfs he recommends to be completely drenched with water at the time the lime is applied; and then frequently turned and champed among it, receiving as much water as they can retain at such periods. By these means they will, he supposes, soon be reduced into a manure of the most excellent quality; all the fibrous parts of the plants will be rotted, and converted into subsistence for the support of new vegetable productions. At the conclusion of the process, as the lime must then have lost most of its costicity, as much dung, or other putrescent manure, as can be spared, may be mixed with the compost. The compost, having been thus formed, should be replaced over the whole surface of the land as equally as possible.

By reducing the vegetable materials of the soils in this way, it is supposed that there is not any loss sustained, as is the case where fire is employed. But it is evident, that even where the process of decomposition is effected in the most easy manner, as by suffering substances to run naturally into putrefaction, there is always a considerable escape of useful elastic matters; it can hardly be doubted but that much loss must take place where it is accomplished with a degree of violence, as must be the case where lime in its caustic state is combined with green succulent vegetable substances. Besides, in this mode of practice, the expense of bringing the materials together so as to be disposed of in this manner, will often be too great to repay the cultivator; and in some situations lime cannot be at all procured. As it is, however, as has been already seen, a convenient and expeditious method of bringing coarse, ligneous materials of the vegetable kind into an earthy condition, it may in different instances be had recourse to with beneficial effects. The separation of ant-hills where they are abundant, and blending them with lime in this way, might also be an useful practice, especially as they often contain much animal matter at certain seasons, and are so bulky as not to be disposed of without being removed from their situations. In all such cases, the quantity of lime should only be such as to exert a gentle operation on the vegetable materials with which it is thus combined; as, where a large proportion is employed, there may not only be a great loss by its too quickly disengaging the elastic matters from them, but by its reducing some of their more fibrous parts into an indissoluble coaly state.

There is, however, another method in which land of this kind may be readily brought into the state of cultivation, where the coarse vegetable matters are not strong or very thick on the ground, as is the case in some coarse pastures. This is that of having a sharp *flay* or *wing* attached to the plough, so as to cut up and deposit a thin paring of the surface or sward in the bottom of the furrow, which is effectually covered by the furrow-slice that is immediately raised by it from below\*. In this way the land becomes at first, after being well barrowed, nearly as fine as by a fallow; and the crop is in less danger of being injured by the growth of weeds. A strong team

\* See section on Implements.



will, however, mostly be necessary in performing this business, which in some instances, where the land is soft and full of moisture, may do harm by the treading that takes place.

In damp, stiff, clayey, or what are frequently denominated *tilly* soils, there is often great labour required in bringing them into the state of tillage. As in these cases too much moisture is generally retained at a little depth below the surface, the soil can seldom be rendered dry to a sufficient depth for the growth of good crops. Proper draining should be here first attempted; after which the land may be opened up as deep as possible by the common plough, having others, such as that which has been termed a *miner*, following in the bottom of the furrow, so as to open and loosen the soil in a very deep manner, and in that way remove the water to such a depth below, as to prevent it from doing much injury to the crop.

When the soil is opened up by the processes recommended above, it is rendered pervious to water to the whole of the depth to which it is loosened; while at the same time the water is allowed to find its way off the ground at a depth so far below the surface, as not to injure that portion of the mould in which the principal roots of the plants abound. Indeed, a great part of that moisture, in these circumstances, never finds its way off the ground at all; but soaking gradually downwards, that water, which, if it had only been allowed to sink three inches, must soon have reached the bottom, and there have been regorged back upon the soil, will require at least five times as long a period to sink to fifteen inches deep, and in its progress will be only gradually moistening, instead of drenching the soil; so that, if the rain shall subside before it has reached the bottom, no part of that water will be carried off the field, unless what flows over the surface; but it will there remain to moisten the earth only to a salutary degree, and, like the water in the stomach of a camel, afford a supply when drought comes on, and parches the surface of the ground: for the deep fibres of the roots penetrating downwards, there will find moisture, which those near the surface would then be deprived of. Thus does the practice recommended operate alike as a cure for the excess of wet as of drought, and produces a healthy vegetation in all circumstances.

Experiments have shown that waste soils of the most obdurate kind, such as consist of thin, moory earth, upon aluminous and pyritical clays of considerable depth, fit only for bricks, may be rendered mellow and fertile, by cutting the hard adhesive surface slices, after being ploughed up, into pieces, forming them into a kind of walls or dykes in order to their being more fully acted upon by the influence of the atmosphere; and after they have been thus considerably reduced, mixing them into composts with lime, and re-applying them, the bare under soil being in the mean time well ploughed or wrought with the spade, and incorporated with lime.

In these ways the practice of paring and burning may in many cases be rendered unnecessary, where the sward is not too tough and matted, or covered too thickly with coarse vegetable produc-



tions; but wherever there is much toughness of the surface, or a great abundance of rough plants covering it, there can be little doubt but that the method of paring it off and consuming it by fire, will be the most easy, effectual, and expeditious manner of bringing the land into a state of cultivation.

As in the breaking up of waste lands, whether they be those of the stiff and heavy kinds, or such as are of a more light and friable nature, repeated ploughings will frequently be required, not only with a view of reducing the sward and other parts into a mellow and pulverised condition proper for the growth of crops, but to fill up the hollows and inequalities that are generally met with in such lands, in order that they may be laid in a suitable manner for the purposes of tillage, it will be necessary to keep in mind not only the peculiarities of the soil and climate, but the kind of crop and the method in which it is to be put into the ground. Thus some of the stiffer sorts of soil, in a climate where too much rain does not fall, may be much benefited by being exposed to the influence of the atmosphere during the winter season; while others under contrary circumstances may be injured, by being thus rendered more liable to become wet and miry, and on the approach of dry weather so hard and compact in their texture as to be improper for the reception and growth of crops; these should therefore be subjected to the operations of tillage chiefly in the early spring months, when the injuries to be apprehended from wetness are daily becoming less. Where some sorts of grain crops, as wheat and barley, and those of the green kind, such as turnips, potatoes, peas, and many others, are to be cultivated, the land should always be rendered more fine and mellow by these means, than where other crops, as oats, &c., are to be grown. And, indeed, wherever the practice of the drill husbandry is to be pursued in putting in and cultivating crops, it is mostly advantageous to have the land as soon as possible brought into a state of as perfect pulverisation as can be effected; as from the frequent stirrings afterwards, under this system of management, there is seldom any danger of its becoming too hard from being baked by the heat of the sun.

In managing the business of levelling the land, as it can seldom be effectually performed by the plough, various implements have been constructed in order to expedite the work; but as they can rarely be managed with that ease and facility that is requisite for the common labourer, it is probable that the spade and common wheelbarrow, or single-horse cart, when judiciously employed, are by much the best implements than can be had recourse to for such work; as by such means the earth can be taken away or deposited upon those parts where it is most wanted, and to the improvement of which it is from its nature and qualities the most suited; a circumstance that ought invariably to be attended to, as in this way the more open and porous materials will be laid in the stiff and adhesive parts, and such as are more close and compact, on those that are loose and friable.

It is suggested that by having barrows to run upon strong coarse pieces of deal in the way of rails, much advantage may be gained,



especially for short distances, in the œconomy of labour; and that small carts or other sorts of carriages, placed upon low broad wheels or rollers, and drawn by one horse, might likewise be useful in accomplishing this sort of business. High carriages, whether carts or waggons, are constantly to be avoided for such uses, as causing much unnecessary exertion, and a great waste of strength in raising the materials.

There is another description of land that is frequently to be brought into the state of tillage, in which the methods that are to be adopted are in some respects different: this is that of the boggy kind. In these, the first thing after having them well drained by the cutting of proper ditches—which, where they are large, may serve for their inclosure, and by giving the ridges a suitable form in order to aid this—is to pare off and level the surface by means of the spade or plough; such matters as are of little value being deposited in the hollows, while those that are of a good quality may be mixed into a compost with good dung, where it can be procured, or with lime: or if the surface materials be very coarse, it may be more advantageous to consume them by fire, together with the spare earth taken from the ditches; or this earth may be afterwards blended with the ashes and a little lime: but, in whichever way, they should be immediately spread equally over the land, and incorporated as much as possible with it, by ploughing it up with a very slight or ebb furrow, in order that the uniting materials may not sink too deep for affording due support to the crop that may be cultivated. Indeed, though deep ploughing may sometimes be of utility in first opening up these soft soils, it should never be had recourse to when the application of manure is to be made, for the reason that has been just stated; and on this account also the ploughings after the taking of different green crops should only be slight. Where the surface of land of this sort has not been pared and burned, in most cases more labour and expense will be necessary in repeatedly ploughing, in order to bring the soil into a proper state for the production of crops. It is seldom proper to continue soils of this description for any great length of time in the state of tillage, as from their great moisture, on account of the general flatness of their situation, and their being liable from continued ploughing to become very loose and open, so as not to afford proper nourishment or stability to the roots of the crops, this sort of land will, in general, be the most advantageous in the state of grass.

The most beneficial sorts of crops for these soils will, in general, be turnips, rape, or potatoes: where they have been pared and burned, the former may be sown broadcast, and be eaten off by sheep, when the land will be ready for some kind of grain crop with seeds. When the ground is very soft, the turnip or other seeds may be sown immediately among the ashes, without ploughing, and be harrowed in with a small harrow, drawn by men, and afterwards rolled well down. In this way it soon becomes so solid as to admit the plough. Rape is more suitable for the firmer and more solid descriptions of land of this sort, on account of its strong roots, which have the tendency of opening and loosening the soil very



considerably; as well as of rendering it highly mellow on the surface, by the thick shade of the leaves. The light and drier parts will be the most adapted to potatoes, as their bulbous roots will be there the most able to spread and extend themselves, and consequently produce large crops. These crops will, in the stiffer sorts of these soils, leave the land in a suitable condition for wheat or oats, and in the lighter for barley or rye. In suitable situations in respect to markets, these soils are well adapted for the growth of many sorts of garden vegetables.

In mossy soils of the more extensive and deep kinds, which form a variety of this description of land, different methods have been attempted in bringing them into the state of tillage. By some the whole of the mossy material has been removed by the aid of water and suitable machinery, so contrived as to raise it above the level of the moss.

The soil that presents itself in this case after the mossy matter is conveyed away in this manner, is a sort of clayey marle, with a considerable mixture of marine shells in different places. Its natural fertility is considerable, but found to be much improved by being raised into pretty high ridges, and exposed to the influence of the atmosphere during the winter season immediately after its being first broken up. Lime, peat, ashes, and manures of the dung kind, are afterwards applied to it with beneficial effects in promoting its improvement. It has been suggested, that as lime, which is highly necessary to such soils, cannot be easily procured in many places, while sea shells are in abundance, they might be easily dug up and converted into lime by a moderate degree of heat. It is probable, too, that by being broken or otherwise reduced into a fine powder without calcination, they might frequently be applied with considerable improvement: though in the state of quick-lime they would be more useful in some cases, by their more ready combination with the acid matters of such soils:—this would seem to be mostly the case where the mossy matter had not been floated away, by which a heavy expense might be saved. Where muscles or other sorts of shell-fish are to be procured in sufficient quantities in the neighbourhood of the mosses, they might also be employed with benefit, when reduced by a mill, similar to those employed in grinding oak bark, and afterwards incorporated with a large proportion of good peat or other earth: as by this means calcareous matter, as well as a rich animal manure, would be at once applied. But, independent of the circumstance just mentioned, the floating of mosses can only be practised in particular instances where the sub-soil is rich and good, as in most situations it has been found that the bottom soil is either composed of rocky materials, whitish granite, or pyritical gravel, and pyritical and aluminous clay, which must constitute a soil much worse than the peat-earth, and which could seldom be cultivated to advantage.

Another method of bringing this sort of soil into cultivation, and which in many situations is much readier and less expensive, as being accomplished without the floating of the moss: this is by the application of lime in its caustic state, in large quantities, after the



land has been rendered as dry as possible by the cutting of large ditch drains. This is a method of practice that has been carried to a great extent, and conducted with much success, in Ayrshire, in Scotland \*, and which has since extended itself over different districts in the same neighbourhood. The benefits resulting from the cultivation of this sort of soil are such as to render it an object of great attention. Such, indeed, are its advantages there, that "the culture of moss has become, in many cases, a distinct species of farming, to which individuals apply, to the neglect of every other pursuit."

The manner of proceeding in bringing this sort of land into tillage is so well described by the author of the valuable paper we have just quoted, that we shall insert it in his own words. "In entering upon the improvement of a moss in its natural state, the first thing to be done is to mark out and cut main or master drains, eight feet in width by four and a half in depth, and declining to two and a half at bottom; these cost one shilling per fall of six Scotch ells. In some instances it will be found necessary to cut these drains much deeper, consequently at a greater expense. These drains almost in every instance can be, and are, so conducted as to divide the field into regular and proper inclosures. They always make it a rule to finish off as much of a drain as they have broken up before they leave it at night, because if a part is left dug, suppose half way, the oozing of water from the sides would render the bottom so soft that they could neither stand upon it nor lift it with the spade. When the moss is so very soft that the pressure of what is thrown out of the drain may cause its sides to fall in again, they throw the clods from the drain a considerable way back; and sometimes have a man to throw them still further back, by a spade or the hand; for this reason, too, they always throw the stuff taken from the drain as equally as possible on each side of it. In digging the drains, the workmen stand upon small boards, to prevent them from sinking, and move them forward as the work advances. When the moss lies in a hollow with only one outlet, it is necessary to lead up a drain, so as to let the water pass this outlet, and then conduct it along the lowest or wettest part of the moss; this middle drain is afterwards sloped, and the stuff thrown back into the hollows that may occur; upon it, the ridges are made to terminate on each side, while a ring-drain, serving the purpose of a fence, is thrown round the moss at the line where the rising ground commences. This can generally be so managed as to divide the moss into a square field, leaving straight lines for the sides of the contiguous fields. The ring-drain intercepts the surface water from the higher grounds, and conducts it into the lower part of the outlet, while the sloped drain in the centre receives and discharges all the water that falls upon the moss. After the moss collapses, in consequence of liming and culture, it is often necessary to clean out these drains a second time, and to dig them to a greater depth: their sides become at last like a wall of peat, which few animals

\* It seems, from Mr. Headrick's account, to have been accidentally introduced by John Smith, esq. of Swimridge Muir, near Bertha.



will venture to pass." In cutting these drains in the mosses in Lancashire, one precaution has been found of the utmost importance; which is, that if the drain be cut to its intended depth at one operation, it will be impossible to prevent the sides from falling in, and no labour can afterwards effectually repair the damage. It is highly necessary, therefore, to attend to the nature and consistence of the moss, and not to cut deeper at one time than will suffer the sides to remain perfectly firm.

When this business has been performed, the ridges are marked out, either by a line, or three poles set up in a line of the proper breadth, and formed in a way that will be mentioned when we come to speak of ridges. These are then to be top-dressed with lime. The sooner, says he, this is done after the ridges are formed, the better. When the moss appears dry, experienced farmers throw on the lime, but do not clean out the division furrows until the ensuing winter. When it is soaked in water, and the lime is ready, they clean the division furrows, and, after the water has run off, apply the lime immediately. It is of great importance to have the lime applied while the moss is still moist, and the lime in as caustic a state as possible. For this purpose they have the lime conveyed from the kiln in parcels, slaked, and laid on as fast as the ridges are formed. Being dropped from carts, and slaked at the nearest accessible station, it is carried to the moss by two men on light hand-barrows, having a hopper and bottom of thin boards, and there spread by shovels as equally as possible. During the first and second years, the crop is generally carried off in the same way. In some places, where a moss is covered with coarse herbage, and accessible by carts in dry weather, they sometimes give a good dose of lime to the moss before it is turned up with the spade, and another after the ridges are formed. It is surprising, how quickly they execute these operations with the hand-barrows. In other places, where coarse boards can be procured, they lay a line of them along the crown of a ridge, and convey the lime upon them in wheelbarrows.

"The proportion of lime allowed to the acre is various, being from three to eight chalders. Improvers are much less sparing of this ingredient now than formerly, and much greater proportions have been applied with good effect. Suppose 120 bolls, or 480 Winchester bushels, of slaked or powdered lime allowed to every Scotch acre; this would cost at the sale-kilns forty shillings; and thus the reader may be enabled to calculate the expense of lime per acre in this district, at every given proportion: but most of the farmers here burn lime for themselves in vast kilns of sod, and think they have it much cheaper than it could be got from a sale-kiln. In many places lime-stone abounds so much, that houses, fences, roads, &c., are constructed with it; and when a farmer burns the lime-stone within his premises, he at least saves the expense of carriage. In some cases, after the lime is laid on, they go over the ground with hoes or with spades, hacking and mangling the clods, and mixing the lime more completely with the superficial



soil; but where there is much to do, and hands are scarce, they seldom think of these operations.

After the land has undergone this preparation, it is in a suitable condition for the reception of the seed, which, it is observed, is sown at the usual season, whether it be *wet* or *dry*, and, as has been already seen, harrowed in by a small harrow, drawn by two men. It is stated that four men will with ease harrow at least five or six roods per day, two and two dragging the harrow by turns, and two breaking and dividing the mould with spades. Where the liming has been accomplished at an early period in the preceding summer, a good crop may mostly be expected; but if it has been only recently performed, the first crop frequently fails, from the lime not having had time to combine sufficiently with the moss so as to form it into a soil. It is probable that this does not, however, wholly depend on the lime not having reduced the peaty earth to the proper state of soil, but partly on its not having neutralised and destroyed the acid properties of such soils.

In respect to the crops most proper to be cultivated on soils of this kind, some variety may be admitted, according as they are more or less wet, and have greater or less depth. But, as a chief point to be aimed at in cropping them at first should always be that of preventing their surfaces from being too much acted upon by the sun and wind, such plants should be provided as have a tendency, by the luxuriance of their growth, and the closeness of their foliage, to afford as much shade and covering as possible; as by the moisture being thus preserved the operation of the lime is much promoted. In this view, potatoes, turnips, winter rye, and rape crops, may, in the slighter boggy soils, be had recourse to with success. The first is a sort of plant that has been found to answer so well, and been so highly productive on all mossy soils, that it is the general practice, where manure can be procured, to cultivate them for the first crop; the custom, in most instances, being to set them on beds or ridges a little raised. Where potatoes are grown more than one year on the same land, the second crop may frequently be put in without dung. Turnips and rape may, however, in many cases, be grown with great advantage, as first crops; on soils of this description, both on account of their great value, the shade they produce, and their being capable of being put into the ground without so much digging as is necessary for potatoes.

Moss-lands, from their being much disposed to the throwing up of grass, are not so proper for the growing of grain crops, but a crop or two may frequently be taken after potatoes or turnips, especially where the liming has been performed some length of time. Oats and barley are mostly good crops, but such land is often too light for wheat. The early white Polish oat is generally recommended in such cases, as being the least liable to lodge, or run too much to straw. Where barley is employed, grass seeds are frequently sown with it, but it is probably a better practice to put them in separately. On those soils, rye-grass, as well as white and yellow clover, have been found to thrive extremely well, especially where they were in



a proper state of preparation for them, as by the growth of potatoe or turnip crops. And though red-clover has not always succeeded, it is probable that, in such mosses as are not of the deep kind, it will be found an useful plant. In some districts it has been found, that clover may be sown with great advantage immediately after the potatoe crop, when it has been taken off early.

And as it is necessary that there should be a tolerable proportion of moisture constantly preserved in these soils, in order to promote the full operation of lime upon them, it would seem to be the most advantageous method, in bringing them into cultivation, not to allow them to be rendered too dry by the cutting of drains, but to proceed with the business in so gradual a manner, as that they may constantly retain that degree of moisture which is most suitable for the complete action of the lime, without being too wet for the crops that are to be put upon them.

It is evident from what has been advanced, that there is much variety in soils of this kind, and that they will of course require different modes of tillage. Where they are very thin, and deposited upon a loamy or clayey substratum, it may be a good practice, after paring and burning the coarse top sward, to plough so as to bring up a portion of them, by which, and the use of lime, the land may be rendered highly productive. But, where they are of much greater thickness it is probably a better method to depend upon the application of lime, where it can be procured in quantity sufficient for the purpose. After paring and burning on lands of this sort, the crops, especially those of the turnip, rape, or grass kinds, may frequently be put in by means of a light harrow, without ploughing or digging them over.

*Ridges.*—In the constructing of ridges on such lands as are to be brought into cultivation, great attention is not only necessary to the nature and quality of the soil, but also to its situation, as by these their size, height, and direction, must in a great measure be regulated. Where the land is of such a nature as to be highly retentive of moisture, or, from the peculiarity of its position, liable to become too wet for the growth of useful crops, the ridges should in general be made narrower, and have a more rounded or convex form, than in the contrary case, or where it is exposed to injury from becoming too dry. But in the first case they ought not, however, to be raised so very high as is sometimes the practice, as by such means much inconvenience is often sustained from the crowns becoming too dry, and the grain ripening in a slow and partial manner. Besides, narrow ridges, with but a little elevation, are, in general, much more effectual in taking away the water that may be injurious.

Where neither the circumstances of the soil, nor the nature of its situation require that the ridges should be formed in a particular manner, or of any certain breadth, that of making them about eighteen feet may be the most suitable, as they are found to answer well in the way of keeping the ground properly dry, and of the most convenient dimensions for turning the teams in ploughing. Besides, the seed, where this method is pursued, can be easily sown by one cast up and another down; an operation which, in other circum-



stances, would be attended with considerably more labour. The covering of the seed by means of harrowing is also accomplished with more facility and dispatch, as, by employing double implements of this kind, one turn may wholly finish the business. In the reaping, too, they have advantages, in allowing the number of reapers that are necessary to work with convenience, and without being in the way of each other.

In wet, clayey, or any stiff and tenacious loamy soils, where the under stratum is clay, they should, however, be ploughed as much as possible into ridges of much less size, in order that they may be kept in a state of dryness suitable to the growth of the crops that are to be put upon them. Three or four feet, according to the degree of tenacity and wetness, may, in such sorts of land, be fully sufficient. In the counties of Essex and Hertford, on this sort of wet soils, three feet are found to answer the purpose in a very effectual manner; and it has been observed, on the authority of much experience, that their superiority over ridges of greater breadths, for taking the water off without washing the land, is incontrovertible. In short, as there is much variation in lands of these kinds, it may be observed, that the width and flatness of the ridges should be increased as they recede from the nature of clay or clayey loam, and approach that of sand, in order that a larger proportion of moisture may be preserved; while, on the contrary, as they are becoming more of a clayey quality, they ought to be narrower, and to have a more high and rounded form, that the discharge of injurious moisture may be more expeditious. In loamy soils they should be either broad and flat, or narrow and round, in some measure, according to the degree in which they approach the sandy or clayey soils. In very wet, clayey soils, where they rest upon a subsoil of some porous kind, great advantage in the way of drainage may often be obtained by sinking the furrows so deep as to reach it. In lands of the marshy or fenny kinds, as mostly approaching in some degree to the nature of these, the ridges should also be made narrow and rather round.

As the principal defect of lands of the sandy kinds is that of parting with their moisture too readily, and of course becoming quickly in a state of too much dryness for the purpose of healthy vegetation, it is the most advisable to plough them into very broad ridges, or even in some cases quite flat, without the least degree of furrow being made, as in this way the moisture may be more effectually retained in such soils.

In forming ridges on such soils as are of the boggy or mossy kinds, some attention is necessary in respect to their depth, and the proportion of wetness that may be present; as where they are thin, and have but little injurious moisture, they may be more broad and flat, than where they are deep of moss, and more retentive of moisture: six or seven yards may, in general, be the best. But, even in the deeper sorts, long experience has shown, that in the first instance it is improper to make them too high or too narrow: where they are made too high, they throw the water off from their sides, without admitting it to penetrate their substance; the top of course gets too



dry: when too narrow, there is a loss of surface, from too many division furrows: the breadths already mentioned are found to be the best; and when the improvement is completed, the ridges appear like segments of wide circles, with a clean well-defined division furrow between each of them. The moisture is thus caused slowly to filtrate through the moss, rendered friable by lime, until it reaches the division furrows, and is discharged. As the moss subsides for some time, and closes in towards the furrows, it is generally necessary to clean these out before winter, and at the time the crop is sown, until the moss acquires solidity.

The ridges in these soils are mostly formed by the spade, the workman beginning nearly in the middle of the part which is to form the ridge, only leaving the space of about eighteen or twenty inches, upon which the materials raised from the trenches on each side are deposited, so as to constitute the crown: and in this way of digging up and turning over narrow spits on each side, he proceeds till he comes to the division furrows, which are cut out and laid on the sides;—the ridge being thus completed, and appearing as if done by the plough. In deep mossy soils, especially those of the more spongy kind, it is probable the breadth of the ridges may be increased with advantage after they have collapsed and become sufficiently firm, as by such means they will be more suitable for being laid down to grass.

In regard to the direction of the ridges in lands of all descriptions, where there is not a necessity of giving them a particular position, either with a view to drainage or some other circumstance of importance, it should constantly be, as much as the situation of the grounds will admit, in the line of north and south; as in this direction much advantage may be obtained in the ripening and drying of the crops, from their being more fully exposed to the influence of the sun and wind. It has, indeed, been remarked, that the shocks, after grain has been reaped should be set in the same direction, and not have an east and west position, as in this case the sheaves on the north side are many days later in being in a proper condition for being conveyed to the stock, than those of the south. Further experience has also afforded the means of showing the bad effects of ridges having an east and west direction; it being found that corn on the south sides, of such as were not by any means high, shot into ear, and changed and ripened a week at least earlier than that on the north; and that at the time of reaping, the wheat on the south sides was, in some patches, too ripe; while that on the north sides was in many parts absolutely green.

In forming ridges in such lands as are hilly, or have much declivity, it is necessary that they be neither made too steep, nor have too much of a horizontal direction, being drawn so as that they may have that sort of easy sloping direction, by which the water can be taken off in a gradual manner. In this way there will not only be great advantage in the œconomy of labour in ploughing—nearly one-third less power in the team being sufficient—but the injury and inconvenience of heavy rains washing down the soil and manure, are in a great measure prevented. The author of “The



Gentleman Farmer" mentions the instance of a hanging field that had been carefully dressed with lime and dug for turnips, and in which the turnips were fairly above the ground, when a heavy fatal summer shower swept down the crop, together with the lime, dung, and a portion of the loose soil, leaving the land bare and exposed.

On such lands as are level, or have but little inequality of surface, the best general practice is, to form the ridges as straight and as regular in respect to breadth as possible, as by having them crooked, and of irregular breadths, the water is not only liable to stagnate, and injure the soil, but the friction in ploughing is greatly increased, and the furrow-slice is not so well laid over, being more disposed to fall back. And besides, many unnecessary turnings are requisite, on account of the inequalities of breadth : by which much time is lost, as well as much trouble given to the ploughman.

In old cultivated lands, where high, crooked, and irregular ridges are frequently met with, it often becomes necessary to have them altered, so as to render them more straight and level. This is, however, a matter of more difficulty, and which demands more knowledge and care in its execution, than is commonly supposed. The most suitable period for accomplishing the work where the plough is employed, is when the land is undergoing a course of repeated ploughings, as in the case of a fallow ; as under such circumstances the more elevated parts of the field may be ploughed over as often, and in such directions, as is most suitable for bringing them into a level state. Where the ridges are not raised to any very considerable height in their middles, but badly formed in other respects, they may sometimes be readily brought into proper order by being split, or cloven down occasionally ; a mode which is performed by beginning at the furrows, and terminating at the crown or middle of the ridge, so that the former furrows become the crowns, and the new furrows are made in the middle of the old ridges ; which being filled by a furrow from each side, has the tendency of soon bringing them into a more equal and level form.

Where the soil is of the light, gravelly, or open and mellow kind, the plough may be conveniently employed in levelling the ridges, without producing any injury of consequence to the crops that may afterwards be put upon the land. It is proper, however, even in lands of these kinds, to use much caution in performing the operation, in order to avoid the injury that might be caused by too large a proportion of the under-soil being brought to the surface in different parts of the ground.

But where the land is of a clayey, loamy, or more tenacious and wet quality, there will be more difficulty, as well as more attention required, in levelling and changing the shape of the ridges ; as it frequently happens that in such sorts of soil, after the earth from the crowns has been removed in order to render the ridges level, especially where done by mechanical means, a coarse, unfriendly, stiff soil is brought up, that requires so great a length of time, and so much amelioration, to bring it into a state capable of supporting good crops, as cannot be compensated by the advantages that may be obtained by the improvement in the form of the ridges ; besides, it



is seldom possible to accomplish this on such soils, without the danger of doing great injury by poaching. Hence it has been recommended not to be attempted, except in cases of considerable length of lease.

It may, however, in particular instances, be necessary, and highly beneficial, to have the business performed, though it should be attended with much trouble and expense—which in districts where labour is cheap may probably be best executed by means of the spade, but in other cases by the plough.

It has been proposed by Dr. Robertson, in his valuable Report of the State of Agriculture in the County of Perth, to begin the process by removing the *made* or meliorated soil, on the crown of the ridge, to one side; which may be done by two or three ploughings in one direction, turning the furrow always one way. This is easier, he thinks, than doing it with the spade. Then, such a quantity of the buried soil may be cast with the spade from the crown of the ridge, as will fill up the furrows at pleasure: and lastly the meliorated soil may be spread over the surface of the whole. If it is not thought enough to save the meliorated soil on the crown of the ridge alone, first one side of the ridge may be taken, and then the same process repeated on the other; by which means almost all the wrought soil may be kept on the surface. A good summer fallow, a hearty dose of lime, and the mixture of wrought mould, will, he says, re-animate the new soil, and restore its vegetative power to its primitive state; and a very few seasons will naturalize the whole soil, while the farmer has the advantage of straight ridges moderately raised.

An useful and very effective machine for levelling the uneven surfaces of lands, has lately been invented by Mr. David Charles, of Westmead Langhorne, in Carmarthenshire, a representation of which may be seen in the 21st volume of the Transactions of the Society of Arts.

*Ploughing.*—This, or some other method of loosening and turning up the superior parts of the soil, is constantly requisite in order to render them suitable for the reception of the seed or crop that is to be cultivated. It is by means of this kind that a convenient bed for the roots of the young plants, and a proper condition of the land for supplying them with due nourishment, are in a great measure provided, as well as a proper state of dryness in many cases afforded. Hence, in performing the operation, it becomes a matter of considerable utility and importance to the agriculturist, to pay particular attention, not only to the state and nature of the ground, but also the season of the year, and kind of crop that is to be grown, as in this way he may frequently render the preparation of his lands more perfect and suitable, and at the same time obviate some of the natural defects under which they may labour. Thus, in almost every description of soils, ploughing them up before the latter part of the autumnal, or beginning of the winter season commences, renders them capable of imbibing and retaining a large proportion of moisture for the succeeding summer; while the turning them up during the spring and summer, causes much waste and discharge of moisture,



by evaporation and other means. Therefore, where the soil in its natural state is too dry, and possesses too little tenacity for the growth and support of such crops as are necessary to be put into the earth in the spring months, the land, by being fully brought into a state of preparation for the crop in the autumn, and the seed introduced without any additional ploughing in the spring season, may be preserved in a more moist and adhesive condition, consequently in a more proper state for the growth of such crops: but where the soil is naturally moist, and the crops that are to be cultivated require that it should be dry and mellow when they are put into the ground, the ploughing, by being deferred for the winter, and performed as late as possible in the spring months, when it is become a good deal dried, will be the more advantageous for the crops that are to be grown upon it.

But, besides these, there are other circumstances that constantly demand notice in the practice of ploughing land. In all the stiff, heavy, and more adhesive kinds of soils, that are much disposed to the retention of moisture, whether they be perfectly clayey, or have more of a loamy quality, it should be a common rule never to plough or turn them up when wet in any great degree, except where the nature of the crop requires it; as, when such sorts of land are ploughed under such a condition, the parts of which they are composed are very apt to cake and run together into hard lumps, that require much trouble and difficulty to be afterwards reduced into a fine state. And further, great injury is produced by the treading of the team, as well as a much greater power necessary in performing the operation. But, at the same time, they should not be permitted to become so dry and hard as to afford too great resistance in that way, before the operation is proceeded upon. Some, however, suppose, that all those soils in which clay prevails over the other ingredients may be ploughed even when wet, without any injury being done, if the business be accomplished before the setting in of the winter frosts; but that the teams had much better remain totally idle than draw a furrow in the spring, until the ground be in a sufficiently dry state.

The marshy, moory, and peaty or mossy descriptions of soils are in general, when in a state of tillage, to be ploughed when the season is dry, as they can seldom be wrought to advantage, and frequently not at all, when they are wet to any considerable degree.

But in the dry, sandy, and probably in some of the more mellow and friable kinds of loamy soils, the business of ploughing, especially for the putting in of the seed, may be performed when they are in a state of considerable moisture, not only without their suffering any inconvenience, or the seed being injured, but often with advantage, as they are liable to part with the watery particles that they contain too readily. On this last account, the very dry sorts of sandy land should, whenever the weather is hot and dry, merely be stirred in such way as may be necessary to prevent the growth of weeds; otherwise the great exhalation of moisture in such seasons may render them too dry for the healthy vegetation of the seeds or plants that may be sown or set upon them. The cultivators of soils of this nature have, therefore, many advantages over those who are



engaged on the more stiff and heavy sorts of land, in being able to perform the various operations of arable husbandry with much less strength and expense of team, and by being much less interrupted by the wetness of seasons.

In regard to the depth and frequency of ploughing lands, they most constantly depend, in a great measure, upon the qualities and the sort of crops that are to be grown. But in general the different preparatory ploughings should be deeper than those of the seed furrow, which ought mostly to be light, and the slice not too much laid over, that the seed, especially where the broad-cast method of sowing is adopted, may be the more perfectly covered.

It is well observed on this subject, by an able practical writer, that though deep ploughing has been greatly recommended by some modern writers, upon particular kinds of land, where the bottom and top are of two opposite qualities, and neither of them perfectly good, that a mixture may sometimes be very beneficial, and the experiment of going below the common depth sometimes answer;—but that where the top and bottom, for eighteen or twenty inches depth, consist of the same soil, he does not believe it is ever worth while to exchange the upper part, which has been enriched for centuries back, for a part less rich, merely because it is more fresh. He has, indeed, he says, observed, that deep ploughing (except for some particular grain and plants) is by no means necessary. The vegetation of ordinary corn and grass does not require any great depth. In many parts of *Cornwall* the land is, he assures us, exceedingly fruitful, though the soil is extremely shallow; and in many other counties they find, by experience, that they ruin their land by ploughing below the usual depth. Besides, when land is ploughed very deep, the roots of the weeds are only turned over and removed, and hardly ever thrown upon the surface to wither; but clean, shallow ploughing dislodges and destroys them much more effectually. Nay, hand-hoeing is, he remarks, allowed by every body to do more towards cleaning land than a ploughing. And even the practice of burn-baking, he contends, effectually cleans land, though it only goes two inches deep. This seems, he says, to show that very deep ploughing is by no means necessary towards cleaning land; and it must, he thinks, be universally allowed, that the longer we keep our manure within three or four inches of the surface the better; especially upon a light soil, from which it is apt to sink, and escape too soon. And Doctor Anderson, who has had much experience in this way, informs us, that though benefits may be derived from the opening up of the soil to a considerable depth in some cases, it is by no means necessary to attempt to plough, on ordinary occasions, to a great depth: on the contrary, unless it be for very particular purposes, he is satisfied that shallow ploughing will, for the most part, be more beneficial than the reverse. In that case the surface soil, in which all seeds must germinate, and draw their nourishment for a considerable period of their growth, will, he conceives, be rendered much more fertile by the same quantity of manure, than if it were mixed with a much greater depth of mould; and as it is known that the fertilising qualities of all manures are carried downward by



moisture, where the soil is so porous as to admit of a slow absorption of that water, the under-soil will gradually become more fertile by this process, which will tend to nourish the crop. On retentive soils, where the practice of loosening them to some depth by other implements is omitted, deep ploughing is, however, he conceives, extremely necessary.

It is further remarked by the first author, that upon all light soils it is necessary to preserve, at six or eight inches below the surface, what farmers call a *pan*; that is, the staple, at the depth, should be kept unbroken; by which means manure will be kept longer on the top: and in dry seasons the less depth the pan has, the less liable the corn will be to burn, provided the pan consists of earth, and not of rock; because the roots of the corn will, he thinks, find more moisture by striking against a body of close earth, than they will in a greater depth of hollow earth; as it is evident the former preserves more moisture in dry seasons. And another advantage which is obtained from this pan is, he conceives, the having a less quantity of mould to work and keep in heart. Where very deep ploughing is practised, this bottom, or pan, must be destroyed; and much more manure will be required in that case, he supposes, to keep the ground in good condition, and fit for the growth of crops.

Before very deep ploughing is ventured upon, the quality of the subsoil of the land should probably be well examined and ascertained; and, when determined upon, should be principally performed in the autumn; in order that the new soil may be fully acted upon by the atmospheric changes during the winter, before the sowing is performed in the spring. It is suggested by an able cultivator, that one deep ploughing, that is, one which is to the full depth, is requisite once in the course of twelve, eighteen, or twenty-four months; which when secured, shallow tillage, by scaling, scarifying, scuffling, shimming, or broad-sharing, is in many cases preferable to deep working oftener, and especially for wheat, which delights in a firm bottom.

It is likewise supposed that animal and vegetable manures cannot be *buried*, whatever the depth may be to which they are deposited, their constant tendency being to rise to the atmosphere;—but that the contrary is the case with those of the fossil kind, having always an inclination downwards;—those of the chalky, marley, and clayey kinds, being so miscible with water as to sink in regular masses, being sometimes found much below the path of the plough. In soils of the poor *hungry* descriptions, it is supposed that some sort of proportion should be preserved between the depth of the ploughing, and the quantity of manure commonly spread upon the land; but which is not the case upon those of the better sorts. Upon the whole it is conceived, that such soils are seldom found as should not be generally ploughed to the depth of six inches, while many ought to be stirred to eight, and some to ten.

In regard to the frequency of ploughing or turning over ground, in order to prepare and render it suitable for the production of good crops, it is obvious there must be much difference, according to the



nature and condition of the soil, as well as the kind of crop that is to be grown. The stiff, clayey, loamy, and even chalky soils will, in general, stand in need of more frequent stirring, either by means of the plough, harrow, or some other implement, in order to separate and break down their tenacious particles, than those of the sandy or gravelly, and more light kinds, in which there is much less adhesion. The nature of the crop that is to be cultivated must, however, in most cases, direct the number of ploughings that may be necessary, as some demand a much finer state of tillage than others; though in most cases a well-reduced earth is favourable. It has, indeed, been asserted, that the finer land of any kind is made by tillage, the richer and more capable of supporting plants it becomes; a proof of which may often be met with in lands where a part has, from accident or other causes, been better tilled than the rest: as, though they be afterwards constantly managed in precisely the same manner, the part so treated always affords better crops than those which have not had the advantage of such tillage.

Where the nature of the crop is such as to be greatly retarded and injured in its growth by the occurrence of other plants, as in wheat and barley, the land will constantly require to be rendered fine and mellow, either by frequent stirring by the plough, or the growing of such preparatory crops as have a tendency to bring it into a friable and clean state, by the shade which they produce, and the repeated tillage and culture which they receive while growing. And where such plants as produce large, knobby, or tap-roots, in or upon the soil, are to be grown, it will be necessary to have the land well broken down, and rendered mellow by repeated turning over, in order that they may more readily push down, or extend themselves in other directions. Besides, it has been seen that a fine state of tilth is always the most favourable for affording the nourishment and support of crops in a free and equal manner, both on account of its admitting the fibrous roots of the plants to spread and extend themselves with more facility, and the manures to become more minutely divided, and more intimately blended with the soils; as well as from the substances that constitute the food of the plants being more readily and more copiously formed by the chemical combinations and decompositions that take place under such circumstances. And further, by means of such degrees of pulverisation and mellowness, the seed, especially when it is of the smaller kind, is not only more equally and more perfectly covered, but its vegetation more quick, from its becoming more fully in contact with the mould, and from the moisture being more minutely diffused and retained in the ground; which is an advantage of much importance in the cultivation of many sorts of crops.

In the choice of implements for the performance of this business, the agriculturist should be careful that they are well suited to the nature and quality of the land, as it is not possible that any particular sort of plough can be employed with equal facility and advantage on soils of different descriptions. The clayey, and all the more stiff and heavy kinds of land, will require ploughs of more strength than those of the thin chalky, and a light, sandy, or gravelly na-



ture. The former may mostly be managed in a proper manner by any of the well-constructed kinds of strong ploughs, as the *Suffolk iron swing-plough*, &c.; and the latter by those of the light sort, as the *Rotherham plough*, *Small's chain-plough*, &c. But whatever description of plough may be had recourse to, it is a matter of the greatest consequence that it be properly formed and attached to the draught; as, where these points are not minutely attended to, there must constantly be a considerable loss in the œconomy of labour and time, as well as in the completeness of the work. With such ploughs as have a suitable form and construction for passing through the earth without affording unnecessary resistance, any of even the heavier sorts of soil may be ploughed with little more than half the strength of team that is employed where the contrary is the case. It has been lately found, that in a light loamy soil, *Small's plough*, with two horses a-breast, and the ploughman driving by means of rope reins, was capable of performing its business with equal readiness, and to a greater depth, when requisite, than the ordinary ploughs of the district with four horses, a ploughman, and a boy as a driver. This advantage, it is conceived, arises from the "symmetry of its parts, and the formation of the mould-board, which is of cast-iron, and so constructed as to afford the least possible resistance in passing through the earth; and in giving the horses the greatest purchase in their draught, by placing them near the plough." But it is remarked further, that "the least variation in the formation of the mould-board, or in the proportional distance of the respective parts," is capable of destroying the effect.

*Harrowing*.—This is a process in tillage that becomes useful after ploughing has been performed, both with the view of breaking down and reducing the particles of the soil, so as to aid the pulverisation that has been effected by the plough, and that of dragging out and clearing the land from root and other weeds that may have commenced their growth, as well as for the purpose of covering the seed.

In the two first intentions the size and weight of the harrows, and the length of the tines, or teeth, should in most cases be considerably greater than where the covering of the seed forms the principal object. And where the land has been laid in a rough manner by the plough, and there are many weeds of the root kind, it will be more advantageous and effectual to have harrows passing in a direction contrary to that in which the ground has been ploughed; as by that means more weeds will not only be eradicated, but the parts of the soil be more fully and more completely divided, broken down, and reduced. And where seed-weeds are to be eradicated, the surface should constantly be at first made as fine and smooth as the nature of the land will admit, by harrowing, to promote their more rapid vegetation, in order that the subsequent operations of the same kind may clear the land in a more perfect manner. Drags, scarifiers, scufflers, cultivators, and what are termed fixed harrows, are often very effective implements in these different intentions, where the soils are of the more stiff and obstinate qualities. Tines of different constructions, according to the circumstances of the land, are also



sometimes employed with considerable benefit, in breaking and reducing the hard and cloddy condition of very tenacious and stubborn soils, that have much of the clayey or strong loamy property.

Where the design of the farmer is only to have the seed covered by the operation of harrowing, it will not be less necessary to have the surface part of the soil, after the seed has been sown, rendered as fine and mellow as the quality of the land will allow; as, where this is neglected, the moisture is not so perfectly diffused through or retained in the mould, nor the nourishment so equally supplied; consequently the vegetation and growth of the crop must be more slow and imperfect. It should likewise be noticed, that in all the more heavy and retentive kinds of soil, operations of this sort, as well as those of ploughing, should be as little as possible performed when the season is inclined to be wet; while in all those which are of a sandy, or open, porous nature, they should be practised as sparingly as the circumstances of the cases will admit, when it is very hot and dry; as in the first, great injury and disadvantage must arise from their poaching, and becoming mortary; and in the latter, from the too great evaporation and dissipation of moisture.

In respect to the manner of performing the process of harrowing when the seed has been sown, the common method, is first along the ridges, then across, and then along again. When the ridges are level, or nearly so, they may be harrowed either way as the farmer may find most convenient, it being of little consequence whether the harrow go first across or along the ridges of a well-ploughed field in proper tilth; but if the ridges are raised in the middle, and the land indifferently ploughed, it would be highly improper to begin by harrowing across, as thereby a considerable share of the seeds would fall into the bottoms of the furrows, and be prevented from vegetating. But as it often happens, that after a field has been properly summer-fallowed, manured, and prepared in the best manner for sowing wheat, the farmer is prevented from so doing by heavy falls of rain. Though no water may appear on the field, yet it is rendered so poachy, that he cannot put on his horses for the purpose of harrowing in the seed, and that circumstance alone prevents him from sowing his wheat in due season. In some parts of Scotland a method has been tried to remedy this inconvenience, which, when the ridges are straight, and not over broad or too high raised on the crown, has, he says, been found to answer beyond every expectation that could be formed. It is as follows: An axle, equal in length to the breadth of the ridge, is fixed on two cart-wheels; and to this axle are chained as many harrows as will cover the breadth of the ridge. To each of the ends of the axle two horses are yoked, and made to walk along in the furrows of the ridge; the wheels turning easily round, and following the horses in the furrows: the horses' feet are, by this expedient, prevented from doing any injury, and the seed is as effectually covered as in the ordinary way. It is necessary, however, he says, that the harrows should not be turned short at the end of the ridge. But, to avoid confusion, it is better to go along one ridge, and return by another; which may be done as often as is judged requisite for harrowing the field in a sufficient manner. It



would here, however, probably be a better practice to have the lands prepared so early as that the opportunity of a dry time might be afforded for harrowing in the seed in the ordinary way.

When grass seeds are sown, the operation of harrowing should be performed only in a slight manner, and with a very light harrow, that has short tines or teeth; as, where these circumstances are not regarded, they will be liable to be put in too deep, and their vegetation of course greatly retarded, if not wholly prevented.

*Rolling.*—This is another operation in the tilling of land, that is equally employed for breaking down and reducing the soil to a fine state of tillage, and for levelling and rendering it smooth, after the seed has been harrowed in. In the stiff, heavy, and adhesive soils of different kinds, the roller may frequently be made use of, in the first intention, with very great advantage; but it should only be employed when such lands are tolerably dry; for, when drawn over the ground under the contrary circumstances, little benefit can be afforded in the way of pulverisation, while much mischief must be produced by the poaching of the horses, and the plastering of the earth round the implement. But, by using it in the manner just directed, all the lumpy or cloddy parts of the surface soil may be effectually crushed, and reduced into a fine powdery state, fit for the reception of the seed. Or if in such sorts of soil it be applied in the intervals between the different harrowings, it may contribute much in the same way, not merely by reducing a great number of the lumps by the pressure that it causes, but by forcing others so much into the ground that they may be acted upon and further broken down by the fermentation that mostly takes place in the soil after land has been stirred. In all the light and more porous sorts of soil, very beneficial consequences may also be derived from this operation, by the consolidation of surface that is thus produced, and the more perfect retention of moisture; by which the seed, especially if of the small kind, is enabled to vegetate more equally, as well as in a more expeditious manner.

In cases where land has been left rough after ploughing, for the purpose of more effectually destroying root weeds, it may also be of utility, by being employed before the harrows, to give them more power in laying hold of and reducing the soil. And by the pulverisation that it affords, and the more perfect retention of moisture that it causes in consequence of the surface being rendered more close and compact, the seed-weeds are produced more abundantly, and more readily destroyed. It is likewise in these last methods that it proves so highly beneficial in all cases where grass seeds are sown; as well as by the equality and smoothness of surface that is thereby produced.

*Manuring.*—In the application of manures to lands in the state of tillage, constant attention will not only be necessary to the nature and quality of the soil and manure, but to the kind of crop that is to be grown with it, and the season of the year, as well as the manner of its being laid on the land. Without proper management in all these respects, much expense and waste of manure may often be incurred, to little or no advantage. For, from what has been already advanced, it is sufficiently evident, that some particular sorts of ma-



nures are better suited, and more capable of producing beneficial effects on some kinds of land than others\*. Thus, on the strong, clayey, or loamy soils, those of the animal or dung kinds, and which are capable of affording large proportions of ammonia or carbonaceous matter in proportion to their bulks, and such substances of the calcareous kind, whether burnt into lime, or used in their natural state, as are the most friable, or have the least tendency to bind and cement the particles of soils together, are the most suitable and proper. And other matters, such as sand, and many similar bodies, that are capable of dividing and separating the parts of such stiff sorts of land, may frequently be employed with great benefit in the view of altering the constitution and texture of them mechanically, though they possess little virtue in the way of manures. But those kinds of materials that have any great disposition to increase the stiffness and tenacity of the soils, must be carefully avoided. Hence clayey marle, and all the more stiff and tenacious earthy substances, as well as what are termed by farmers the hot sorts of lime, are in such cases disadvantageous and improper for the purposes of manure. Where sand is employed on soils of this description, it should be laid on them, when convenient, in proportions suitable to the tenacity and stiffness of the land, and under such circumstances of tillage as that it may be the most capable of being minutely blended with it. The common sand can, however, only be laid upon lands with the view of its altering their textures, so as to render them more mellow and proper for the growth of grain crops. Sea sand will be found highly beneficial, not only in this view, but likewise in conveying a portion of fertility. But, from the saline matters that it may contain, it may be either laid immediately on the land, or be mixed with dung and other manures into a compost before this is done, according to the circumstances under which it is laid on.

On the perfectly loamy soils, especially where they are of the mellow and more friable description, almost every sort of manure that is produced on the farm may be made use of with benefit. But where they approach much towards the stiffness of the heavier sorts of soils, clayey marles may be improper; and where they abound with calcareous matters, lime, chalk, and other substances of the same kind, should be less freely employed.

In the application of manure to lands of the *marshy* kind, when they are brought into a state of arration, similar attention will likewise be necessary. It has been observed, that where these soils are composed of a heavy, moist sleet, a very sluggish species of land is formed, on which the crop is lodged from year to year, before it arrives at maturity; which makes it of little value. A quantity of sand from the beds of rivers, when laid on such soils, enables them, however, to produce excellent crops of plump grain, which stands until they are cut down.

But on the sandy and all the lighter sorts of tillage lands, such manure as possess the property of promoting and augmenting the tenacity, or of bringing the particles more closely together, of retaining moisture, and of affording stability to the roots of plants,

\* See Section on Manures.



will be the most favourable. In these views, clayey marle, the sediments and dispositions of ponds or rivers, loamy and peaty earths, &c., with farm-yard dung, may be had recourse to with propriety.

In Suffolk, on the sandy districts, the earthy substance applied is generally a clay marle; though a pure, or nearly a pure clay, is preferred to very loose sands. But when the *clay* is not of a good sort, that is, when there is none, or scarcely any clay in it, but it is an-imperfect, and even a hard chalk, there are great doubts how far it answers, and in many cases it has been spread to little or no advantage. The quantity usual is from sixty to eighty, and sometimes one hundred loads an acre, the load containing about thirty-two bushels. Many experienced farmers, however, prefer carrying forty or fifty loads only, and repeating it after the first course. The best mode of doing it, according to some, is to lay down the land with grass-seeds for a couple of years, and then lay the clay upon the turf the latter end of the summer, and breaking up the land in the spring following, to set with pease, if the land be proper for that crop. It is, indeed, conceived, that one hundred loads per acre are, perhaps, not too much for newly cultivated heaths or warrens. But for other fleet soils, which have been for a long time under cultivation, fifty, or at most seventy loads, are quite sufficient. On such soils, to lay on too much is attended with great loss. In this way the land receives more immediate benefit, and double the number of acres may be clayed in the first years of the farmer's lease, without any additional expense. The duration, and indeed the whole effect, it is observed, depends much on the course of crops pursued. If the plough be too freely used, and corn sown too often, it answers badly, and the effect is soon lost; but with good management it lasts twenty years. Where the management is good, and the clay well adapted to the land, the profit is also very great. In many cases a course of fallow and rye, or *light* oats, is converted to fine barley, clover, and wheat, and the produce of the soil, multiplied twenty-fold; but, on the contrary, the cases in which the return has been inadequate are not a few. And it is believed that it will be found, that on soils that will yield sainfoin, it is more profitable to cultivate grass, than to clay the land for corn. There are various sorts of clay in use; some so exceedingly strong and loamy, that they will not mix with the soil; others strong, and full of particles of chalk; and another sort very tender, and which has a mixture of sand: the second is believed to be the best; the use of it prevails very much at present in the strong wet lands in high Suffolk, even where *clay* is ploughed up. Within a few years, the mixing clay with maiden earth and muck out of the farm-yards is very much practised; and good farmers tell you, that muck should never be carried upon the land alone: the reason of which it is said is, that muck produces straw with little corn; but to grow a full crop of corn, compost must be used.

The business of claying, marling, and chalking, may be carried on during many of the winter months when the weather is sufficiently dry, and in most of the summer ones, when the farmer has leisure for conducting the work. In the very extensive practice of Mr. Rodwell, as detailed in the second volume of Communications



to the Board of Agriculture, it was found to be the cheapest method to let the work to persons who are accustomed to the nature of it, and who have teams strong enough for the purpose. The expense was about eightpence the yard for every thing but spreading; it has, however, lately increased to ninepence and even tenpence. He however suggests, that the method of hand-barrowing would be the cheapest mode of doing this sort of work, especially on the heavier kinds of soil, if workmen could be procured who were used to the operation and expert at it, as is the case with those employed in navigations. In this way, men, he says, can make good wages at tenpence per yard, wheeling it thirty rods; and down to sevenpence a yard at shorter distances. The proportion of these substances on sandy soils is mostly from about fifty to sixty cubical yards the acre, but upon those of the more loose, wet, loamy kinds, one hundred.

Moss or peat earth, either in a state of combination with farm-yard dung or in its natural state, has likewise been found highly useful. Upon light land, where there is a great proportion of sand or gravel, the mossy material naturally retains the rain and the dew, which that kind of soil could not naturally retain; and, by this supply of moisture, preserves such dry soils from the effects of severe drought. After it is ploughed in, it likewise not only acts as a sponge, but forms an addition to the staple of the land; which are circumstances not to be disregarded in the use of manures. The manure produced by the turning in of succulent green vegetable crops may also sometimes in soils of this kind be attended with success.

In the arable management of peaty, mossy, or moory soils, the most advantageous application in the way of manure in the first instance will, in general, be that of lime, or some other of the substances that abound in calcareous matter, in large proportions, together with the ashes that have been formed where the practice of paring and burning has been adopted in bringing them into cultivation. And after these have been well incorporated with the soil, farm-yard dung, where it can be procured, may be had recourse to with great benefit. Clay, sand, gravel, and various earthy substances of a similar nature, may also often be made use of on such soils with great utility in the way of rendering them more firm, and giving them greater compactness of texture.

In the use of manures, besides adapting them to the nature and properties of the soils, the agricultor should be careful to apply them in such ways as may be most suitable for the production of their fullest effects. In this view, the nature of the crop, the condition of the manure, and the mode of its application, are to be well considered; for it has been found from practical trials, that where particular sorts of manure have either been naturally found in the soils, or artificially laid upon them, some kinds of crops may be grown and brought to perfection much more completely than where such impregnations have not taken place; while on the contrary, other sorts of crops can scarcely be produced at all, until a different sort of manure has been incorporated with the mould. Thus it is observed, that the common pea, whether white or gray, cannot be



reared to perfection in any field which has not been either naturally or artificially impregnated with some *calcareous* matter. And hence it is supposed to happen, that peas are rarely cultivated universally as a field crop, unless in those parts of the country where either lime, marle, or chalk abounds, or upon strong clays: except, indeed, on the sea-coast, where shell-fish are often caught in abundance, and where the fields are manured with their shells in a state of mixture with dung. But it is remarkable, that a soil that could scarcely have brought one pea to perfection, although richly manured with dung, from their running too much to haulm, and, after blossoming, dying away without becoming ripe, if it has once had lime applied upon it, is capable, when properly prepared in other respects, of producing plentiful crops of peas ever afterwards. It is further remarked by the same writer, on the result of an experiment, in which the ridge of a field that had been missed in liming produced no good wheat, while all the other parts afforded a full crop, that lime, or some other calcareous material, is equally necessary for the production of good wheat crops as for those of the pea kind. The general observation that the wheat, where this sort of manure has been employed, is thinner in the skin, more plump, and yields better, seems also to favour the same conclusion. Impregnations of this sort appear likewise, it is supposed, particularly favourable for the production of barley crops, much more so, especially if in large proportions, than for those of oats.

But, on the contrary, turnip crops are found to be produced in the best manner where the land has been enriched by means of dung; while lime, or other calcareous substances, do not promote their growth in nearly so high a degree. This is also in some measure the case with cabbage, potatoe, and other crops of a similar kind. Hence it is concluded by the author just mentioned, that turnips are the most suitable for first improving crops in such districts as are destitute of calcareous matter, and peas in those which abound with it.

As in the cultivation of different sorts of crops there are some that require large supplies of nourishment during the more early stages of their growth, while others demand smaller proportions, but to be continued with great regularity and evenness for a considerable length of time, it will be proper and advantageous to apply the manures in such states as may be the most favourable for these purposes. Thus, for those sorts of luxuriant crops that stand in need of much support in their early growth, such as potatoes, cabbages, turnips, carrots, peas, beans, and other similar ones, they should not only be laid upon the land in a less reduced state; especially where the lands are light, but be applied in such manner as that the crops may derive the benefit of them in the most full, equal, and expeditious manner. Hence in the two first, as well, perhaps, as in some of the other kinds, it may be the most beneficial method to place it in drills with the sets or plants, and in the latter to be lightly ploughed, harrowed, or otherwise put in, immediately before the seed is sown. But as in the turnip, and other similar crops, from the smallness of the seed, and other circumstances, a much



finer state of surface is necessary than for the other kinds, it may be proper, especially where the manure is only harrowed in, to have it shorter and more rotten than in the other cases.

In the application of manure for grain crops, as they are frequently liable, especially in the better sorts of soils, to be greatly injured by an over-luxuriant growth, where the dressings are laid on for the immediate crop, it may be a better practice in such cases to have them applied with the different preparatory fallow, or green crops, such as turnips, pease, beans, cabbages, carrots, &c., as in this way great advantages will be obtained, not only in the production of such crops, and their bringing the lands into the most perfect order for the growing of grain, but in the manures being more fully and more completely blended and incorporated with the soils. Where the quality of the land is not very good, and the method of summer fallowing is pursued, it may, however, in some instances, be a good method to apply the manures upon the fallows, both for the wheat and barley crops; as, under such circumstances of the land, it is probable they are most capable of being minutely blended with the soil, and consequently of affording the most equal support to the grain. Where calcareous substances, such as fine chalk and the shell marles, are to be made use of, it may also be the most suitable method to apply them when the lands have been reduced to a considerable degree of pulverisation and fineness, by ploughing, or other means; as under such circumstances they will be much better and more minutely divided and incorporated with the mould of the soils than could otherwise be the case: a point on which we have seen that much advantage depends in the application of such matters. Such materials are frequently laid on the land in their simple states, and in making use of them at first upon a soil, it may be the most beneficial method; but where they are often repeated, the practice of mixing them with earthy or other substances may be more advantageous\*.

In regulating the proportions or quantities in which manures ought to be applied to lands under the state of tillage, various circumstances are to be taken into consideration; such as the nature, situation, and condition of the land, the manner in which it has been previously employed, the kind of crop that is to be grown, and the strength or goodness of the manure to be applied. The quantity, however, in general, may be from about fifteen or sixteen to twenty tons the statute acre. Where, however, the main object of the farmer is that of bringing the land into a proper state of cultivation, or that of affording a considerable degree of amelioration and improvement, it will often be necessary to have recourse to much larger quantities, if it be possible to procure them.

In turning down clover, or other new lays, where there is a considerable proportion of vegetable matter upon the surface, with the view of sowing wheat or other crops upon them, it will seldom, perhaps, be requisite to have recourse to such soft dungings as may be proper under other circumstances; but in all such cases the manures should not be turned into them to too great a depth, as, where that is

\* See Section on Manures.



done, the immediate crop will often derive little or no benefit from such dressings.

But in whatever method, and in whatever proportions, manure of the dung kinds may be employed, it should always be spread out with as much evenness as possible, and be turned into the soil as soon afterwards as the work can be performed with facility. In conveniently accomplishing these points, it will be necessary to deposit it upon the land in small heaps, and not to have too much carried out at a time; as by the first method the spreading may be effected with much greater exactness, and by the latter, the whole may be turned into the soil so quickly after its application as to prevent the waste arising from evaporation, or the effects of rain; circumstances of great consequence where manures may be applied either in very dry or rainy seasons.

But where substances of the calcareous kinds, such as lime, chalk, marle, shelly matters, and even sea or other sorts of sand, are to be made use of in the way of manures to tillage lands, as much of their beneficial effects evidently proceeds from their being very minutely blended with the particles of the soils, they may be applied with the greatest chance of advantage where the lands are undergoing the culture of repeated ploughing, as in fallowing for wheat, turnips, &c., for in such circumstances their parts are in the greatest state of division, or what by farmers is mostly termed mellowness, and of course in the most suitable condition for admitting the particles of such materials to be the most evenly blended and incorporated with them. In this intention, these sorts of materials should always be set on in such a manner, and be in such fine states of pulverisation, as that they may be spread out upon the lands very equally. By choosing a rather dry season for the business, and depositing the substances in small heaps along the ridges of the fields, such work may, in general, be well and conveniently executed.

It is obvious that these sorts of manures must be used in different quantities according to their qualities, and the differences in the soils\*. It is, however, the common practice to apply a larger quantity to the heavy and stiff sorts of land than to those of the lighter kinds. Lime is used in different districts at the rate of from one to four or five hundred bushels in proportion as the soils seem to stand in need of it. Chalk, in its calcined state, is employed in the proportion of from one to two hundred bushels, and in its crude state to a much larger extent. Marle and sea or other sorts of sand are laid on in various proportions, from one to two thousand bushels, and in many cases even considerably more. When used on tillage lands, marle should always be well broken down and reduced, as, without this being duly attended to, but little benefit will often be produced.

Where lime, either from chalk or limestone, is made use of in repetition on the same land, it may frequently be more beneficial to employ it in the form of compost, with rich earths and other materials, than in its pure state, as under such circumstances its effects in different cases have been observed to be more beneficial. When

\* See Section on Manures.



made use of in such a state, the quantity laid on must, however, be considerably larger in proportion to the goodness of the substances that are blended with the lime. When applied to the surface of coarse sorts of land, with the intention of breaking them up, and bringing them into the state of tillage, much larger quantities than have been mentioned above may sometimes be required, and which must be regulated by the nature and situation of such lands, as has been already noticed. Lime may also, sometimes, be used on the wheat, turnip, or other crops, in the early spring months, especially where danger from grubs, or other insects, is apprehended. In such cases it is probably the best method to employ it in very fine powder, and in its caustic state, sowing it over the crops with as much regularity as possible. This should be performed when the weather is dry, as in a rainy season injury might be done to the crops by the caustic properties of the lime.

In applying materials of the dung kind, or such as contain saline matters, as ashes, soot, &c., in this manner, it will also be necessary to have them reduced into a state of fine powder, in order that they may be spread over the crops with regularity and evenness. The effects of substances of this sort will also be greater, if they are sown over the crops when the weather is inclined to be wet.

The use of substances that have been much reduced and broken down, by being thinly sown, and spread out over the land by the hand, is a practice that may be more generally had recourse to in situations where manures are scarce and expensive, as in this way the growth of crops may be promoted with but a comparatively small quantity of them. They are, however, much less constant in their effects than such as are turned into the soil, and of course can only be employed for the immediate crop. Where permanent advantage and improvement are to be given, the more massy sorts of manure, either of the animal, vegetable, or fossil kinds, must be applied according to the state and circumstances of the soils.

Various materials may be made use of in the manner of top-dressings for arable land, such as rags reduced by cutting or chopping to very small pieces; rabbit, pigeon, and the dung of poultry in general; soot, the ashes of wood, turf, peat, and coal; different animal matters, such as horns, bones, hoofs, &c., after being brought to a coarse powdery state by grinding, or other means; the combs and dust of malt, and the refuse of various sorts of seeds, such as flax and rape, &c.

The rags are applied in various proportions according to circumstances, from half a ton to a ton and a half or more, being sown over the land immediately before the last ploughing, when they are lightly turned in, and the seed sown: their effects when used in this mode are often observed for several crops. These rags are purchased in London at from about 3*s.* 6*d.* to 4*s.* 6*d.* the hundred weight, which, with the carriage home, cost one shilling more: but in the country they are bought at from 4*s.* 6*d.* to 5*s.* and are collected at about 2½*d.* the hundred weight. They are afterwards housed and chopped at the expense of 5*d.* or 6*d.* the cwt.; the extra expense of this and carting to the field being about 4*d.* the cwt. They are



sown over the land by hand, being ploughed in, in the practice of some, three months before sowing wheat or barley. In these cases the proportion is from six to ten cwt. for the statute acre. From their holding moisture they are adapted to dry gravelly soils and those of the chalky kind, being of little service on the wet sorts of land. On the former, in dry seasons they answer very highly. The London rags are considered the best.

The dung of rabbits, and different sorts of birds, are mostly employed for barley or turnip crops in the proportion of about sixteen or twenty sacks to the acre, each sack containing three bushels, being thinly sown over the land after the last or seed-furrow has been given, and harrowed in with the seed. They are frequently also sown on the young wheats and clovers in the spring, with great advantage; but when used in this way, they should always be laid on very early, especially on the drier sorts of soil, as about the latter end of January; but on such as are more wet, February, or even March, may be more proper. When their application is deferred to too late a period, there is often danger of their being less useful from the increased dryness of the season, and their rendering the land, in some cases, more apt to burn.

The vegetable ashes, and those of turf and peat, are likewise found useful to the young wheats and clovers, when sown over them in the spring, in the same quantities as those of soot; or a considerably less proportion of wood-ashes, as eight or ten bushels, may be sufficient. They may also be used on the turnip fallows with great benefit, being spread over them, and harrowed in with the seed. If sown over the turnips in the early stages of their growth, wood-ashes are likewise said to be beneficial in preserving them from the ravages of the fly.

Mr. Farcy says, that those from peat are delivered on the land about Dunstable at  $4\frac{1}{2}d.$  the bushel struck, being dispersed over the land by a shovel from the cart or barrow, or, which is preferable, by sowing them with the hand, at the same expense as those of the coal kind. Forty bushels are a full dressing, and costs about 16s. They are applied in the same season and to the same crops as coal-ashes, and also to the wheat crops in April, with great advantage. They improve dry chalk soils, but do little service on those of the wet kind. Peat-dust, which is another article made use of, costs the same, and is employed in the same manner and proportions, is attended with similar effects and success. It has also much effect on thistles, when continued for some time. It is remarked that coal-ashes cost in London from 6s. to 14s. per waggon-load (narrow wheels and four horses), the price depending on the business doing in the brick-fields near town, in which considerable quantities of ashes are used. Carriage included, they cost on the land about  $5\frac{1}{2}d.$  per bushel. They are bought in small quantities in the neighbourhood at  $4d.$  per bushel, and collected to the land at about  $1d.$  per bushel, being distributed on the land with a shovel, from a cart or wheel-barrow moved along the land, or, which is a preferable mode, by sowing them by hand. The former way costs  $12d.$  per waggon-load, the latter  $13d.$



In Hertfordshire, where these sorts of dressings are, perhaps, more used than in any other district, coal-ashes are principally employed on the clover crops, being brought from the different collectors of them in the county, or brought in back-carriage from London on taking the grain to the market during the winter season, and sown over them in the early spring. They are usually laid on at the rate of about twenty or five-and-twenty sacks, of three bushels each, to the acre, and in this way are found of such utility as to prove the practice highly economical, and deserving of more general imitation by the farmers of other districts. They succeed well when sown on clover in March or April, on dry chalk lands; and also do much good to sward, applied during any part of the winter or spring. They are never used on wheat. In very dry seasons coal-ashes do little good: they, as well most other of these dressings, on light land, require rain after being sown to set them to work.

Soot is chiefly laid upon the crops of wheat, sainfoin, and clover, that have had no previous manuring. It is usually sown over them with the hand, in the proportion of from twenty to thirty bushels, or even more, to the acre, about January or February, having been collected into heaps during the winter for the purpose. When soot and substances of the same sort are had recourse to, they should invariably be preserved in places constructed for the purpose, and covered over so as to protect them from the rain and wetness, as, where this practice is neglected, the saline matters contained in them, being dissolved, are carried down and lost, by which means their valuable properties are considerably diminished. The custom of laying them in large heaps in the fields, exposed to the weather, however convenient, should therefore always be avoided by the attentive farmer, as wasteful in a high degree. The soot from coal is brought from London, Mr. Farey says, at from 7*d.* to 9*d.* the bushel struck, but, from the deficiency in the measure, costs from 9*d.* to 11*d.* the Winchester bushel struck. From the heaps in which it is deposited in the field a common seed scuttle is filled, and a man, walking the length of the lands, sows the soot in the same manner as corn is sown. The expense of sowing is a half-penny per bushel. The quantity used per statute acre is from twenty to forty Winchester bushels. In general thirty bushels are used for a complete dressing: that is, when dung, or some other manure, has not been previously applied to the same crop, which is very frequently their practice, and the quantity of top-dressing is then diminished to about one-half of a complete dressing. Of soot, a complete dressing as above costs 30*s.* to 36*s.* per acre. It is found to answer best on wheat in April. It likewise succeeds on pease or clover, in the same month, and has a good effect sown *with* barley in the beginning of April, and harrowed in. A slight dressing of soot is used at any time in the spring, when grubs or worms appear to injure the young corn. The worms frequently make great havock about Dunstable, by drawing the blades of young corn after them into their holes: this, soot prevents best. When thinly distributed on newly-sown turnips, just before they come up, it prevents the fly or grub from injuring



them, provided no rain falls to wash it into the soil. It answers best on light dry chalk soils, and in moderately wet seasons. It does little good on strong or wet land, or in very dry seasons, unless sown earlier than usual. The London soot from coals is rarely bought unmixed with cork-dust, coal-ashes, or sweepings of the streets; yet even in this state of adulteration it is found to answer much better than the real country soot from wood.

The combs and dust of malt are commonly made use of as a hand-dressing to the young wheat crops, and those of barley, turnip, and clover. They are employed at the rate of from thirty to forty bushels, or more. They are frequently sown with barley and turnip crops, in Hertfordshire, at the rate of about thirty bushels to the acre, and harrowed in. This manure, like many others of those applied in the same way, is found to be the most beneficial where sown over the crops at such periods as that their effects may be promoted by the succeeding rains.

Where bones, horn, hoofs, and other hard animal materials are to be made use of in this way, they are commonly sown over the land in the quantity of from about half a ton to that of a ton to the acre, according as they are reduced or broken down, before the last ploughing, and immediately turned in with a light furrow. If too large a proportion of this manure be employed, the grain, it is said, becomes too luxuriant, and too long in ripening, as well as liable to injury from mildew. When made use of in the more lumpy or unreduced state, they should be turned into the soil a greater length of time before the seed is sown, in order that time may be given for them to undergo decomposition, and impart their nutritious properties to the earth.

Furriers' clippings, the same writer remarks, are brought from London at the rate of from 12s. to 13s. the quarter, which is a ten-bushel sack crammed full, weighing about  $2\frac{1}{2}$  cwt. The carriage to the land costs 3d. more the quarter. In their application they are sown by hand from the seed-scuttle, at about 3d. per quarter, on the land intended to be sown with wheat or barley, and immediately ploughed in; after which the seed is sown, and harrowed in; when such pieces of the clippings as are left above ground by the harrow, are pricked or shoved into the ground, by the end of a stick, to prevent their being devoured by dogs or crows, who seize them greedily. From two to three quarters are usually sown per statute acre: these clippings answer well on light dry chalk or gravelly soils, where they are supposed to hold moisture, and help the crop greatly in dry seasons. They have but little effect on soils of the wet kind.

Horn-shavings are another sort of article used in the same way. They are of two sorts, small or large. The small are purchased in London in the same way, and generally at the same prices as the clippings. The large cost about 2s. less per quarter. They are used in the same way and quantities as the last article, except that they want no pricking, and the large are generally ploughed into the land three months before sowing wheat or barley. Horn shavings answer in most soils and seasons, except very dry ones, when they will not work. The small shavings are much the most useful.



There are other articles of this sort, viz. sheeps' trotters and fellmongers' cuttings. They are, Mr. Farey says, procured from the neighbouring fellmongers, at about 6*d.* the bushel heaped loosely. The carriage to the land is about 2½*d.* per bushel. They are used in the same way as furriers' clippings, from twenty to forty bushels per acre, and need pricking in, as dogs and crows are very fond of them. They do not answer on wet land, or in very dry seasons: indeed nothing succeeds in excessive dry seasons on these soils. The trotters contain a considerable quantity of lime, and are often adulterated with sand, and sometimes considerable quantities of oak saw-dust are mixed with them, which has been found not to injure them in any respect.

The hair of hogs, which is sometimes to be had in London at about 9*s.* per quarter (the same quantity as furriers' clippings), and carriage 3*d.*, when applied in the same manner with clippings, has been found to answer well in some cases.

The refuse of oily seeds, when laid upon heavy sorts of land in the manner of a top-dressing, is frequently blended with a little lime, as about six parts to one; but upon light or calcareous soils it may be used alone. It is usually sown over the wheat crops, at the rate of eight or ten bushels to the acre, and in some places dispersed over the lands in the state of preparation for wheat or turnips, and then lightly turned into the soil. This is sometimes the practice in the county of Norfolk.

The expense of the application of manures in this way must obviously be very different according to situation and other circumstances; but, in general, considering the great way they are made to go, and the readiness and convenience of their application, they may be said to be cheap and economical.

In regard to the season of applying manures to land in the state of tillage, it must always depend in a great measure upon the convenience of the farmer, the state of the soil, and the nature of the crops that are to be produced; but where these do not interfere, the dissipating heats of the summer, and the washing effects of the winter and autumnal seasons, should as much as possible be avoided. For where they are laid upon the ground in the hot summer months, except they be immediately turned into the earth, a large proportion of their most beneficial properties must be forced off into the atmosphere by the continued action of the heat, and be wholly lost; and where they are applied in the more rainy periods of the winter, they must be liable to be dissolved, and carried away into the surrounding ditches of the fields, or to such a depth below the loosened mould as to be of but little utility to the crops. The early spring, before the hot weather sets in, and the latter end of summer, before the heavy rains begin to fall, and when the heat is becoming daily less, where the nature of the crops will admit, would probably be the most advantageous periods for their application, though the business is most commonly performed by farmers during the more vacant periods of the drying summer season and of the winter frosts \*.

\* See Section on Manures.



*Ploughing-in Green Crops.*—This is a method that has been employed in husbandry for a very considerable length of time on the continent, though it is but little practised by the farmers of this country. This probably, arises in some measure from the soils being in most districts too wet and heavy for its being had recourse to with much advantage; the light and more friable kinds of land being the most adapted for improvement in this way, as in such descriptions of ground the green materials undergo decomposition much more speedily and become more readily in the proper state for affording the nourishment and support of crops. Indeed, in some of the clayey soils, the putrefaction of such substances is retarded in such a manner, that little or no benefit can be derived from them.

In soils suited to this method of manuring, crops of the green kind, such as buck-wheat, tares, clover, rape, and, where sown for the purpose, peas, or beans, &c. might be turned in as a preparation for wheat crops, without the expense of fallowing. Where this practice is employed, the crops should always be turned down when in their most luxuriant stages of growth, and when the soil is rather dry, in order that a speedy decomposition and decay may take place. It is probable, also, that advantages may be gained in this view by the application of small proportions of calcareous substances in their caustic or more active state, over them, before they are turned down\*. The œconomy of this practice must chiefly depend upon the savings in cartage, and the labour of preparation, which in other sorts of manure must always be considerable.

*Folding of Sheep on Tillage Land.*—This method of improving tillage land seems to have been practised from the most early periods of the art of agriculture, and to be still had recourse to in different districts of the kingdom with the most beneficial and advantageous consequences. It however can only be employed with much success where the nature of the farm admits of the sheep-husbandry being carried to some extent in combination with that of arable cultivation; and where the soil is of such a dry mellow, and light porous quality, as require to be rendered more solid and compact by the treading of the animals. In such as are much loaded with moisture, or are very stiff and heavy, it will be improper and injurious. The treading, in the last sorts of land, tending to render them more close and compact, they of course become more improper for the growth of most sorts of crops by the practice.

As it is probable, that much of the beneficial consequences of this method of husbandry in tillage lands must proceed from the action of the ammonia formed from the urine and excrement of the sheep, it is easy to suppose that mossy or peaty soils, as containing much vegetable matter on which it can operate, may likewise be greatly improved in this way, as well as by the consolidation of the land from the treading of the animals. It is, indeed, impossible to suppose that the whole of the advantage that is obtained in many cases of this sort of soil, by the folding of sheep, can be produced solely in the latter mode.

\* See Section on Manures.



The practice of folding may be usefully employed on such soils as we have seen to be proper for it, in the summer season, either as a preparation for wheat or turnip crops, in which cases the soil should not by any means be stirred to any great depth in the ploughings that may be given after the folds have been formed, as by turning in the surface-mould that has been rendered rich and mellow by the process, to a considerable depth, the good effects of the practice must obviously be in a great measure lost. In many instances it may perhaps be the best method merely to harrow in the seed without any further use of the plough; or what is probably a still better practice, especially on very light soils, is that of folding the sheep upon the land immediately after it has been sown. In hot seasons, the turning it in by a slight furrow, as preventing any loss by evaporation, may, however, be right. Folding may also be had recourse to in the spring months, both as a preparation for the barley-crop, and as affording vigour and support to the young wheats, especially where the soils are so light as to endanger the crops from the looseness of the mould about the roots. In the last method the sheep must be suffered to remain upon the land only a very short time each day, and be put in at so early a period of the growth of the crops, that no injury can be produced by the pulling up of the plants in the feeding of the animals.

There is still another method of folding, which is sometimes made use of during the winter season, where the lands are sufficiently dry; this is that of confining the sheep upon such stubbles as are intended to be ploughed up in the spring. But in the first methods the folds should not be nearly so extensive as in the last; a flock of one hundred and fifty ewes and lambs being in the former modes confined on about four or five rods of ground, while in the latter they ought to have ten, fifteen, or even more.

From the nature of this mode of manuring land, it must be obvious, as has been observed, that it can only be employed with much success where there is a considerable extent of common, grazing, or pasture land, annexed to the arable; or where green crops, such as turnips, tares, rape, and other plants of a similar kind, are cultivated upon a pretty large scale; as, where the sheep have not such descriptions of land to feed and fill themselves well upon, the evacuations made by them can only be such as to afford a very slight improvement to the ground.

There are besides these some other circumstances to be attended to in the management of this business on arable lands. The sheep should constantly be kept as near as possible to the lands that are intended to be improved by the sheep-fold, in order that no injury may be done to the animals, and that as little loss as possible may be sustained during the time they are in driving from the pastures to the folds. In this view, such a number of folds will be necessary as may allow the sheep not to travel further than would be sufficient for their feeding in other cases, proper pasture or other lands being always provided for them as contiguous as may be to the grounds to be folded. In these it will also be an advantageous plan to keep them confined when the weather is wet, and improper for their being



driven and folded upon the ploughed lands, as under such circumstances the lands are not only often much injured by the practice, but the animals greatly hurt.

The sheep, in all cases of folding for the improvement of arable lands, should be suffered to fill themselves very well on the pastures or other grounds, before they are driven to, and inclosed in, the folds on the ploughed lands. Hence it is probably the best method to let them remain on the green food, the whole or greater part of the day, and only inclose them in the folds during the nights, as in this way the greatest amelioration will not only be effected, but the least injury sustained by the animals. In the mornings, before they are turned out of the folds, it may be a beneficial custom to have them driven briskly once or twice about the folds, in order to promote the evacuations of urine and dung.

The kinds of sheep that are the most suitable to be employed in this business, are those of the Devonshire, or west country breed, as being the most hardy, and bearing the confinement of the fold better than those of the larger and finer kinds; but many of the other sorts may be made use of in the same way, in districts where the above breeds are not kept, though a little more care may be required in the managing of them.

*Warping.*—This is a method of manuring and improving tillage lands, that can only be practised in particular situations; as in the vicinity of large rivers and waters into which the tides of the sea flow, and where the level of the grounds is such as readily admit of their being overflowed by them. The aim of the farmer in this mode of manuring land is, by admitting the floods or tides of such rivers to flow over and stagnate upon the land, to obtain a considerable sediment or deposition of muddy and slimy or other matter upon the surface of the ground, so that a new soil may as it were be created. In order to this, the tide is let in at high water to deposit the warp or enriching substance, and suffered to run off again as it falls. But to produce the full effect, it will be necessary to have the water under such command that it may be kept out or let in as occasion may demand. This is accomplished in most cases by the cutting canals so as to join the rivers, and fixing sluices at the heads of them, which may be regulated at pleasure, so as to admit the water of the spring tides only, and others in proper places for discharging or taking it off the land. And that the water may stagnate upon the lands to a sufficient depth, and be prevented from overflowing the adjoining grounds, banks are raised all round the inclosures to be warped, of from three to six or seven feet in height, according to the situation and other circumstances of the land, having proper slopes on each side. Where the land to be improved by this means is of considerable extent, the main canal may be cut to a great length, so as to warp the lands on each side of it, by lateral cuts in suitable directions to a considerable distance. But as the effects in these cases are found to diminish in proportion to the distance from the river, a greater length of time will be necessary for the deposition of the warp according to the distance from it. That it is not the water that produces the benefit in these cases, but the



deposition of mud, is evident from the business being discontinued in the warping districts during fresh-water floods, as well as in the winter season. The result of the analysis of this muddy sediment has shown it to consist of much mucilage, a very small portion of saline matter, with a large one of calcareous earth; the residue being mica and sand, each in a very minute state of division, and the latter in much the largest proportion. It is also suggested, that though no mention is made of any argillaceous material, from examination of the warp on the fields, it is obvious that it is present in some cases. The stiffer sorts of warp are also supposed by some to be the best.

As a sort of new soil is created by this practice, it is of but little consequence what the nature of the land may be, almost all kinds being improved by it. It will probably, however, be the most beneficial in such light soils as are very open and porous, and such stiff ones as are defective in calcareous matter, and which require substances of this kind to render them less tenacious. The best situation of land for performing this business in, is when it is in the state of fallow; but it may be done when in that of stubble or other similar condition, and even in that of sward, when the grass begins to decline. The season of doing it is generally in the summer months, from May or June till August or September; as at these times the lands not only become the soonest dry (a circumstance which must always fully take place before the process of cultivation can be carried on), but the tides are less mixed with fresh water, in which situation they are constantly found the most effectual. Land, when once well warped, will continue for a great length of time in good condition: but notwithstanding this, it is suggested by some persons conversant with the business, as a better practice, to apply a small portion of warp whenever the land is in the state of fallow, which under the arable system, will be about every five or six years. By this means the farmer will be more secure of having good crops. The depth to which the lands are covered with the water must be various, according to the differences of their levels and the heights of the tides in the rivers from which they proceed. When it can be done, it may be admitted to the height of three or four feet or more, as the deposit of sediment is in some measure proportionate to the height of the water; though the same effects may be obtained from much smaller quantities of water, by continuing the process a greater number of tides. Lands that have been subjected to this mode of improvement should constantly be kept in the state of tillage for some length of time afterwards, in order that it may be brought to a proper condition for the production of grass.

The expense of this method of improving lands will be very different in different cases, as the circumstances of situation and distance vary; but it can seldom exceed twelve or fifteen pounds the acre; and in most instances it must be greatly below such estimates, probably not more than a third of them.

Lands after having undergone this process, are mostly capable of producing abundant crops of almost any kind; but in general oats are the most to be depended upon for the first season; and they are said to be more proper for the growth of this sort of crop, and those



of wheat and beans, than barley, as the soil becomes so rich in this way, that it suffers in general by being too rank and coarse. Flax may likewise be grown in many cases to great advantage. They are also admirably adapted for potatoes, as well as various kinds of seed crops, and the being laid down for the purpose of pasture. The practice of warping is adopted on the rivers Trent, Ouse, and Dun, with great benefit.

## SECTION XII.

### *Cultivation of Arable Land. — Sowing. — After-Culture and Arrangement of Crops.*

IN order to perform the business of sowing or putting in crops in the most advantageous and perfect manner, it will be necessary for the farmer to pay particular attention to a variety of different circumstances, such as the quality, preparation, and quantity of seed that is to be put into the ground, the time and depth of sowing it, the state of the season, and climate in which it is to be sown; the nature of the land, and the particular kinds of seeds or plants that are to be cultivated upon it, for on properly regulating and adapting his practice to these points, much of his success will probably depend. It will also be of much utility to have regard to the particular modes in which the seeds or plants are to be put into the soil, as some variation will be required according as they are sown or put in by the broadcast, drill, or dibbling methods.

It seems to be shown by the experiments and observations of an intelligent philosophical enquirer, that grain or seed during the act of vegetation draws oxygen from the atmosphere, part of which is retained, and the remainder thrown off charged with a portion of carbon. In this process the substances of the seed-lobes, therefore, undergo a considerable change, an additional proportion of oxygen entering into their composition, while a portion of their carbon is dissipated. By this alteration in the proportion of their constituent principles, the saccharine fermentation takes place, and sugar is formed, as demonstrated in the operation of malting grain. The sugar and carbonic acid, from their being more soluble in water than the *oxid* of the farinaceous matter, easily, it is supposed, combine with the moisture in the capillary vessels of the seed, and find a ready passage to the germ, the vegetative principle of which is thus brought into action by a *stimulus* adapted to the particular nature of it. By the decomposition of the seed-lobes, a nutritious fluid being thus formed and distributed through the infant plant, its organs are excited to exert their specific actions, in decomposing the nourishment conveyed to them, and in forming new *oxids* from the elementary principles



of it, in order to the increase and evolution of the vessels and fibres\*. In this way, it is imagined, the first stage of vegetation commences; which if the ingenious author's conclusions be well founded, would seem to shew that the grain or seed, in order to its undergoing these different changes the most readily, and in the most perfect manner, on which, perhaps, healthy vegetation may depend, should not only be properly deposited in the soil, but be so well ripened and filled with farinaceous matter, and possess such a degree of moisture, as may dispose it to undergo such changes in a speedy manner, while at the same time a due supply of suitable nutritious matter is afforded for the healthy germination, and early growth of the young plant.

In respect to the choice of seed of the grain kinds, it should, therefore, be a rule with the farmer to purchase or reserve such as is the most full, plump, sound, and healthy, of whatever description it may be, as it is only in this way probably that crops of good grain can be insured. And this practice is further enforced from the circumstance of its being in some measure the same with plants as with animals, that the produce is in a degree similar to that from which it originated.

But it is not merely on this principle that such grain as is small, shrivelled up, and imperfectly fed, should be rejected as improper for seed; but as containing a smaller proportion of farinaceous matter, and being thereby, as has been seen, less proper for affording that degree of nourishment and support which is necessary to the young plants during the period of germination, or the first stage of their growth. Where such seed as is shrivelled up, and imperfectly ripened, is sown, in general but a little of it vegetates, and that which does, mostly sends forth plants of a weak and feeble kind, that afford only a lean and steely sort of grain. Besides these, there are other circumstances which ought to be taken into the account in the choice of seed corn, such as that it be new and recently threshed from the straw, and that the skin be clear and thin; for it is found that grain which is fresh and only just threshed out, is in a much more proper state for quick vegetation than such as has been long kept, consequently less liable to perish in bad seasons; and that where the rind or skin is of a bright colour, and thin, a much larger proportion of fine farinaceous or mealy matter is yielded from the same quantity of grain, which renders it of course more valuable to the cultivator. This is particularly the case in wheat, and the same thing probably takes place in respect to other sorts of grain. The experiments of a late writer seemed indeed to shew, that wheat, after being kept six or seven years, though there may not be any perceptible difference in its appearance from such as is new, is wholly unfit for being made use of as seed, on account of only a small portion of it being capable of vegetating. This may, probably, in many cases be owing to the grain being more disposed under such circumstances to take on the putrefactive fermentation, or become rotten, than to the absorption of oxygen, which is believed to be essential to the process of vegetation, in the early stage.

\* Gough on the Vegetation of Seeds, in the Memoirs of the Manchester Society, vol. IV. p. 210.



It is probable, too, that besides this effect where the moisture and juice of the grain is much taken away, as is the case in keeping it for a considerable length of time, the plants that are produced from it may even be less vigorous and luxuriant, as happens in gardening to some kinds of seed, as that of the melloon, which is frequently kept for several years, in order to effect this purpose the more fully.

On the principles which have been stated above, it is therefore obvious, that in order to secure the most perfect vegetation of grain, it should not be placed too much out of the influence of the atmospheric air, and that the bed of earth in which it is deposited be in as fine a state of pulverisation as possible, as under such circumstances the air is more uniformly admitted, and the seed, from being in a more equal temperature, and more equally supplied with moisture, is exposed in the most favourable manner to the combined effects of the causes that have been found to promote the germination, growth and prosperity of the young plant.

As to such grain as is in any way diseased, it should never be made use of as seed. The experiments of the author of the *Sinopsis of Husbandry* clearly prove, that no method of preparation that has been yet attempted has been sufficient to render it capable of producing healthy plants. In his different trials he invariably found, that in wheat which was affected with the *smut*, the grains universally produced a succession of ears that were tinged in a greater or less degree with the distemper, and that neither steeping nor the change of soil made any difference in preventing it, but that that which had been steeped and limed, as well as that which was sown dry, afforded diseased ears. The sowing of this sort of seed, though it may have been advised by some incautious agricultors who have placed too much confidence on the efficacy of *steeps*, can only disappoint the expectations of the farmer in propagating more widely the ravages of such vegetable diseases, and producing scanty supplies of sound grain.

There is still another point that ought not to be overlooked in regard to seed corn, which is that it be clean and perfectly free from the seeds of every sort of weed, as where this is not sufficiently attended to, crops may be greatly injured, if not wholly spoiled, by the growth of weeds, and such noxious plants introduced into the soil as cannot be removed again without considerable trouble and expense.

There are different methods that may be pursued in order to secure such grain as is healthy, and proper for the purpose of seed. The best is probably that of selecting from amongst the corn while it is growing in the fields, as in this way an opportunity is afforded of choosing such heads or ears of the plants of different kinds, as are the most perfect, the most forward and vigorous in their growth, and which contain seed that is the most plump and full, and the best ripened. These advantages may likewise, in some respects, be attained in the more valuable sorts of grain, by having them picked over by the hand after being threshed out; but the practice



is tedious, and not so certain of having the seed from the most healthy and best ripened plants.

In order to be possessed of the best and most perfect sorts of seed, the most healthy and vigorous plants should therefore be chosen, and such as are the most early in respect to the season, and these while growing be so preserved that they may not be injured by having weaker plants of the same kinds near them; as the art of having good seeds does not, it is asserted by an experienced agriculturist, depend upon obtaining new seeds from situations at a considerable distance; but upon collecting and preserving the best seeds or roots of our own production. This method of practice has been adopted in consequence of having remarked that, though vegetables of every kind are extremely liable to undergo changes in regard to the periods of their becoming ripe and other properties, the best seeds never fail to afford the best plants.

There are various methods of ascertaining the goodness of grain or seeds, but the farmer chiefly depends upon the appearances that they exhibit, preferring such as are full, plump, well fed, and that have a certain brightness and clearness, without any shrivelling or shrinking in the covering or skin. The same purpose may, however, be accomplished with greater accuracy by other means, as the weighing of a certain measure; it being well known that grain or seeds, on being immersed in fluids, have the more light and imperfect floating on the surface, while the better and more perfect sink to the bottom. On this principle, solutions well saturated with saline substances, from their gravity being much increased, become excellent for ascertaining the goodness of grains; as none but such as are perfectly sound will sink in them.

His grain that has undergone fermentation, or been heated much, or burnt in the stack, as it is mostly termed by farmers, is improper for seed, from its not being capable of vegetating, it may be of utility in many cases to be able to discover where this has happened. The following method, which is perfectly simple, has been recommended for the purpose. A paste is to be made with water from the flour of the suspected grain, which is then to be washed by the hand under water, which is frequently changed, until no discolouration of it takes place. The substance which is left in the hand is the glutinous part of the grain, and which, if the corn be good, is elastic, contracting readily on being drawn out: if it has only been just heated, it is brittle; but where it has fermented, none of the gluten will be afforded.

Much has been advanced by some agricultors on the importance of changing of seed of the same kind, probably from adopting imperfect notions of the nature of vegetation, or pursuing false analogies in respect to the breeding of animals, but it is evident from the trials that have been made in the cultivation of grain, and from what happens in particular cases of gardening, that it will be of no utility to have recourse to the change of seed, provided it is properly adapted to the soil, except it be for an improved kind. The only thing necessary is that of collecting and preserving the best of the different kinds, in the manner that has been directed above, and



by that means prevent a degeneracy. It is hardly to be supposed that the soil can become tired of, or be improper for, producing a sort of grain for which it is adapted, since it may be observed that the same sorts of plants are frequently propagated on the same spots of ground for a vast length of time without any manifest injury in respect to their quality.

As some of the varieties of the same sort of grain or seed, when sown under similar circumstances of soil and climate, are however often found by the cultivators of land to be of a much more early growth than others, as well as of a more or less hardy and vigorous nature, it may be of utility to change them in these respects, the early kinds being always cultivated on the colder and more backward descriptions of land, while those of the later are sown upon the drier and more warm soils. In this way the crops may often be considerably improved, as, in so far as regards themselves, they will enjoy the advantages of more genial soils and climates. Another advantage may be gained in this method, as by employing such early kinds of seed the farmer may, in some cases, delay the putting in of his seed for several days, without the danger of the crop being injured thereby, or of its not being reaped at the usual time. He may likewise in the late soils thus obviate the difficulties and inconveniences attending bad seed times, as by such a change the seed, though put in later, may be equally early at the harvest.

On the whole it is maintained by an ingenious writer, that as the varieties of plants are supposed to be produced by different soils and climates, which varieties will afterwards continue through many generations, even when the plants are removed to other soils and climates, it must be advantageous for the agricultor to inspect other crops, as well as his own: and thus, wherever he can find a superior vegetation, to collect seeds from it; which is, it is imagined, more certain to improve his crops than an indiscriminate change of seed. And that where seed-corn is purchased without a previous observation of its superior excellence, perhaps it would be more advantageous to take it from better kinds of soil, and from somewhat better climates; as the good habits acquired by such seeds may be continued long after their removal to inferior situations. But, on the contrary, care should be taken not to collect a change of seeds from worse climates or inferior soils, unless the agricultor is previously certain that they are of a superior kind.

Though the practice of preparing seed of particular kinds for being put into the earth, by some means or other, seems to have prevailed, in some degree, since the earliest periods of the art of husbandry, the utility or advantage of the process does not appear to be yet fully ascertained by agricultors; some contending that it is highly beneficial, while others maintain that no possible benefit can be derived from it. It can, however, hardly be conceived, that a practice of this sort should have been employed for such a vast length of time, without some beneficial consequences had been observed to result from it. The nature of the vegetation of seeds, and the circumstances under which it takes place in the most favourable manner, would also seem to shew that it may be had recourse



to with benefit in more cases than it appears to have been customary to employ it by the farmer.

Various compositions have been employed at different times for the purpose of preparing grain which is to be made use of as seed. In the more early attempts in this way, oils, and the decoctions or juices of particular plants, were chiefly employed, and the most fully relied upon; but the liquors which have lately been the most depended upon, are either water so highly impregnated with common salt that an egg will swim upon the surface of it, or such chamberlye as has been kept for a length of time sufficient for its undergoing decomposition, and the forming of ammonia. And whichever of these liquids is made use of, the seed, after being steeped for a proper length of time, is rendered dry and fit for sowing, by caustic or quick lime, in a fine state of pulverisation, being intimately blended with it.

By modern agricultors, steeps or pickles of these kinds appear to have been principally made use of for preparing wheat, in order to prevent it from being affected with disease; but it is probable that they may be applied to most other kinds of seed, and in very different views, with still greater and more beneficial effects. As it would seem necessary that the seed-lobes of grain, which have been found to consist of a vegetable *oxyd* or basis, compounded of carbon and hydrogen, impregnated with oxygen, a portion of oil, or of the basis of it in an unoxysated state being diffused through their composition, should be imbued with a certain proportion of humidity or moisture, in order that such changes may take place in them as are suited to the process of vegetation; the steeping of seed may, in this way, not only secure a more speedy and regular germination, but in some cases obviate the danger of its being injured or destroyed by the length of time it may be necessary for it to remain in the soil before it becomes sufficiently moistened. And as it is probable that different kinds of seed absorb or take up different proportions of moisture in the same time, this circumstance should be attended to in the practice, and such sorts as are found to charge themselves slowly, exposed in the steeps for a greater length of time.

In proof of the utility of steeping in this view, it has indeed been observed, by an experienced agricultor, that there can be no doubt that, in every particularly dry seed time, seed of every kind ought to be steeped just enough to promote a quick vegetation. This method would, it is thought, at all times prevent great destruction by vermin, secure a more uniform growth, and greatly improve both the quantity and quality of barley and oats; and sometimes, indeed, procure a crop of clover, which would, without such precaution, have been lost. And others suggest that by soaking seeds a day or two previous to their being put into the soil, their growth may be promoted equally as well as by watering the land by artificial means, either immediately before or after their being sown. But besides these the steeping of seed-grain may be useful in other respects; as, where attention is paid to having the liquors as much as possible saturated with saline matters, it may, as has been seen, enable the



farmer to readily separate the faulty imperfect seed that is incapable of vegetating, from that which is good and proper for the purpose, as the light imperfect seeds constantly float upon the surface of such liquids, and may be easily removed, while those which are sound and good fall to the bottom, and by being employed as seed may insure more regular, perfect, and uniform crops.

And where liquids or substances of a poisonous or destructive quality, such as the solutions of noxious plants, caustic lime, &c. are had recourse to, they may be of utility both by rendering it less the prey of vermin, and destroying such as attack it. The latter may likewise be of advantage by its properties of attracting the humidity and moisture of the surrounding air and soil, as well as by destroying such insects as come in contact with it.

It may, in some instances, also be of advantage to make use of such liquid materials as have been found useful in promoting the growth of plants, such as the carbonated liquor afforded by dung-hills, and many similar matters. It has been found, that by steeping seed-barley for twenty-four hours in a fluid of this sort, removing the light grains that came to the top, and, on taking the grain out of the steep, sifting wood ashes over it in order that it might be sown with regularity, a much better crop was produced than from the same grain sown without undergoing any preparation. In China, the use of such fluids for the steeping of seed is likewise supposed to be equally beneficial in promoting the growth of the crop, and preventing it from being destroyed by insects.

In regard to the effects of such preparations in the prevention or removal of the diseased conditions of seed, there are different opinions entertained by agricultors; some contending that they are wholly ineffectual, while others maintain that they have derived the most evident advantages from them. Satisfactory experiments have, however, yet gone but a little way in determining the matter. The few trials that have been made by the author of the *Synopsis of Husbandry*, with respect to smutty grain, seem to shew that they cannot be much depended upon in this view, though they do not throw much light on the nature of the disease.

The manner of performing the business of steeping is different in different places; but the most common way is that of forming the brine, in the mode that has been mentioned, in a large tub or other convenient vessel, and then simply putting in the grain and permitting it to remain for ten or fifteen hours, removing the light grains as they come to the surface, after stirring it at different intervals. But another, and much more expeditious and convenient method, is that of placing the seed in a basket, and letting it down into the vessel containing the steep, skimming off the light corn occasionally, and after it has remained a proper length of time, according to the views of the agricultor, removing its contents, and replacing them by other parcels.

In whichever way the process of the steeping is performed, no larger a quantity is to be prepared at a time than is capable of being put into the ground the succeeding day, as where the grain is suf-



ferred to remain in the steep for any great length of time, much of it is found to be incapable of vegetating. In further proof of this, the writer of the Agricultural Survey of Mid-Lothian says, that about four years ago, having steeped a firlof of barley in urine for about three hours, and immediately thereafter caused it to be sown at the usual rate, in the middle of a field, unmixed with any other, there was not above a half of it came up, and even that grew so weakly as not to produce above a third part of the crop with the rest of the field. An able experimenter has, however, shewn that greater latitude may be taken in this respect than is commonly supposed. And Mr. Middleton has known seed prepared a week before it was sown, without sustaining any injury. As the experiments of Mr. Gough have, notwithstanding, shewn that the process of germination presently commences after seeds have been imbued with a suitable proportion of humidity, it would seem to be the most proper practice not to delay the sowing much after the seed has been prepared.

In regulating the proportion of seed that may be necessary to be sown, attention will not only be requisite to the peculiar nature, quality, and situation of the soil, and the periods of sowing or putting crops into the ground, but also to the state of the season, and the manner in which the sowing is performed.

In general, for most sorts of crops, the strong, wet, and stiffer descriptions of land will require larger proportions of seed than such as are more friable, thin, and light. Hence the strong wet loams, and the stiff retentive clays, demand more seed than the light mellow loams, and the sandy, gravelly, or even the thin chalky soils. As where lands of the rich loamy kinds have been suitably broken down, and reduced by the various operations of tillage already described, if the seed be not sown in too large a proportion, an opportunity is afforded for the plants tillering, or spreading themselves from the roots, many stems often issuing from the same root: in consequence of which, the crops frequently become, even when thinly sown, extremely thick upon the ground; and from the great nutritive powers of such soils, or what is mostly termed strength by farmers, would be greatly too much so, if a large proportion of seed were at first put in.

And, indeed, in the case of root crops, whether such as are formed upon or within the soil where such lands are in a sufficiently mellow and friable state for producing them, the seeds or sets should not on the same account be sown or put in in too great a quantity or too thickly.

But in the strong, stiff, wet, retentive, soils, from the plants seldom striking or branching off much from the roots, except in particularly favourable circumstances of season, a much greater proportion of seed will be necessary, in order to secure such full crops as lands of this kind are capable of supporting.

On the light thin soils a less quantity will, be sufficient, as if a large proportion of seed be put into such kinds of ground, from their possessing but little strength in comparison with the former, the crops will rarely, except in particular seasons, be well formed in the



ear, or have the grain plump and well fed. It is likewise a practice in the best grain districts, on all descriptions of soils, to sow smaller proportions of seed on lands of the same quality in the early periods of the seed time, than those of the later. The reason of this, according to the author of the work just quoted, is, that grain sown early in the season takes deeper root, and has more time to branch out additional shoots, than that which is late sown, which, when the soil is not very free, as well as fertile, generally runs up into one single stalk, so that if a liberal quantity of seed be not allowed, the crop, however luxuriant in respect to the plants, must be scanty in the article of grain.

From what has been advanced it must be evident that the quantity of seed must vary according to a great variety of circumstances, and that it is a matter of much difficulty to fix upon any proportion that may be suitable to every circumstance and description of soil. From two and a half to three and a half bushels to the acre may, however, in general, be considered as the proportion that will be the most frequently requisite, both for the spring and autumn sowings. It has been suggested by an experienced cultivator, that for sowing wheat broadcast about the latter end of September, two bushels and a half is the most advantageous quantity on soils of a medium quality; and that for every fortnight later a gallon of seed should be added. Nothing can, however, be said with much exactness on the subject, since the advantage of different proportions have not yet been fully shewn.

But though the proportions of seed that may be the most proper and advantageous for affording the fullest and most abundant crops in different cases, and under different circumstances, have not yet been decided by the aid of experimental investigation, the only method that appears capable of affording any degree of certainty on the subject; there is still another point that should never be overlooked by the correct agricultor, which is that in sowing seed that is known to be good and perfect in its quality, a less quantity will always be sufficient than where the contrary is the case, as in the former instance almost every seed will vegetate, while in the latter, many must prove faulty.

The time of sowing, or putting crops into the ground, is evidently a matter that must depend in a great measure upon their economy and the peculiarity of their nature. Hence the most proper and advantageous season for sowing or setting such as possess the habit or are capable of perfecting and ripening their seed or produce in the same year, is that of some of the more early spring months, according as they are more forward or late in their kinds, and the climate more mild, or the contrary; while in such as are, from the peculiarity of their nature or habits, incapable of completing their vegetation in the same year, the most favourable period will be some of the more early autumnal months, according to the differences of their habits, and the variations of climate and season; as by these means in the former case the seeds, grains, or roots become perfectly evolved, and the radicles of the young plants firmly established in the soil, and capable of sustaining themselves against the hot season sets



in which is to bring them to maturity; and in the latter the seeds have attained such a state of growth, and so far fixed their roots in the ground, as to be capable of supporting themselves without sustaining much injury from the severity of the winter season, and consequently advance with greater rapidity in their vegetation in the spring, in order to perfect their seed by the heat of the summer season. It has, however, by some cultivators been particularly advised to adopt the practice of sowing certain sorts of grains and seeds, and also of setting particular kinds of roots, at much earlier periods in the spring than is commonly had recourse to by the farmer. Thus by putting barley into the ground in the beginning of February, great advantage has been supposed to have been derived in the forwardness and fineness of the grain.

Against this method it is, however, ingeniously suggested, that as much moisture, with or without subsequent frost, is more liable to destroy the embryo in its very early state in the seed than after it has shot out roots and a summit, and thus acquired some habits of life, such early sowing must in some cases be practised with caution. Such an objection cannot, however, be brought against the early autumnal sowings.

In the depositing of seeds or roots in the soil, it may be necessary to pay some regard to the depth to which they may be introduced and covered; as upon these being suitably performed according to the nature of the seeds or roots, the qualities of the lands, and the state of the climate, different advantages may be obtained in the early vegetation and subsequent growth of the crops.

In such seeds or roots as are to be put into the ground in the spring months, as there is generally a large proportion of moisture in the soils from the continued rains of the autumnal and winter seasons, it may be unnecessary to cover them to any great depth; half an inch or an inch may at most be sufficient, so as to fully protect them from birds and insects, for grain, turnip, carrot, and other similar seeds; and for roots, such as potatoes, and others of the same kinds, from two to three or four inches, according to circumstances, may be as much as is requisite. But, in the early autumnal sowings, as, from the great dissipating heats of the summer months, there must in general be less humidity in the earth, it may be useful in such circumstances to have the seed buried somewhat deeper, as two inches or more, in order that their vegetation may not only be more speedily effected, but their roots more fully guarded from the effects of the frosty nights, which usually take place soon after such sowings. Besides, they will thus be more effectually protected from the attacks of birds and other vermin, which are generally more eager and destructive from the diminished quantity of food at such periods.

But in general, as we have already seen that the process of sprouting or early vegetating is greatly promoted by the seeds being fully supplied with oxygen air, it may be the most beneficial practice to have them but lightly covered or put into the soil, in rather a superficial manner, as by such means they will be the most fully supplied with atmospherical air. And on this account too it may



be the most advantageous method to have the seeds or roots deposited in the soil as soon as possible after it has been turned up by the plough or the spade, as in such circumstances it must, as has before been noticed, contain the largest proportion of atmospherical air among its constituent particles; which it is observed may be necessary to stimulate into elevation the plume of the embryo plant, as the moisture of the earth is necessary to stimulate the root into its elongation downwards, or in other directions. The depths of such sowings may be the most perfectly regulated by the use of drill machines.

The state of the season, and climate, in which grain seeds or roots are put into the soils, may likewise have some influence on the crops, as has in part been already explained. It has been generally supposed that the best practice is that of sowing in dry seasons, and setting out plants in such as are moist; but it is obvious that, in so far as the sowing is concerned, this business ought, in some respect, to be conducted according to the differences of the qualities of the lands, and the nature of the climate in regard to its warmth, or the contrary. Thus in the drier and more mellow and porous descriptions of soils, and the more warm and genial climates, it may in many cases be advantageous not only to sow in the wet, or rather moist seasons, but also at more early periods in such as are more retentive of humidity; as from the moisture being commonly, in such sorts of land, quickly dissipated, a more certain and expeditious vegetation of the seed may in this way be secured.

But in the more heavy and wet kinds of soils, where the climate is colder, it will constantly be a more beneficial method to choose, if possible, a dry and warm season for performing the business of sowing or putting in the crops, as by such means the grain will be more certain of vegetating, and in less danger of perishing by the overabundant wetness, and the want of heat, in such lands and climates. And it has been well remarked, that in some clayey grounds much softened by rain, if the seed be put into holes, and a dry season succeed, an almost impenetrable crust may be produced by the quick exhalation of the moisture, and what is termed by farmers the setting of the clay; and in this manner the vegetation and early growth of the crop be much retarded, or in a great measure prevented.

In regard to the nature of the soils, and the crops or kinds of seeds, or plants, that may be cultivated upon them with the greatest chance of profit and advantage, it may be generally observed, that these may be the best and most perfectly adapted to each other, so as to afford the most abundant and most valuable produce, by attentively observing what sorts agree most fully in the nature of their nutritive properties, their states of moisture, their condition in respect to pulverisation or mellowness, and their situations in regard to warmth. Thus on all the more light and friable descriptions of soil, such as those of the sandy, gravelly, chalky, and mellow loamy kinds, barley, oats, peas, turnips, carrots, and various other sorts of green crops, as well as those of grain, may be successfully cultivated; while those of the heavy, gravelly, chalky,



loamy, marshy, and stiff clayey, will be more suited to the growth of wheat, oats, beans, clover, saintfoin, and other sorts of grasses of the artificial kind.

But, besides the properly adapting the nature of the crop to that of the soil, as tillage lands are liable to be injured by the repeated growth of particular sorts of crops, as those of the grain kinds, there is another circumstance that ought invariably to be kept in view, which is that of preventing the exhaustion or deterioration of such lands by the judicious and attentive interposition or alternation of such as are ameliorating, either by their shade or other properties, or but of a slightly exhausting nature, with such as are more powerful in robbing the soil of its nutritious properties; such as those of the green, and which are often termed cattle kinds, with those of the white or corn kind. In this way, besides the prevention of injury, in so far as respects the exhaustion of the soil, advantages may also be gained by the land, from the different means of tillage which are thus required.

*Sowing.*—In regard to the practice of sowing or putting the seed into the earth, different methods are followed, not only in districts where the nature and qualities of the soils are different, but in those in which they have much similarity. The most general and common mode, as well as that which is more or less prevalent in almost every part of the kingdom, is that of sowing or casting the seed over the surface of the ground by means of the hand, having it afterwards covered to a proper depth by harrowing. In this method of performing the business, the most usual practice, especially where the ridges are equal in breadth, and not of too great a width, as five or six yards, is that of dispersing the seed regularly over each land or ridge, in once walking round; the seedsman, by different casts of the hand, sowing one half in going and the other in returning. In doing this, it is the custom of some seedsman to fill the hand from the basket or hopper, which they carry along with them, as they make one step forward, and disperse the seed in the time of performing the next; while others scatter the seed, or make their casts, as they are termed by farmers, in advancing each step. It is evident, therefore, that in accomplishing this business with regularity and exactness, upon which much of the success of the crop must depend, there is considerable difficulty, and the proper knowledge and habit of which can only be acquired by experience. Wherever this method of putting in the seed is had recourse to, it is consequently of importance for the farmer either to perform the operation himself, or to be careful in selecting such persons as are conversant with the business, as he may otherwise incur much unnecessary expense in the waste of seed, and run considerable risk in respect to his crop.

It has indeed been well observed, that in this way of sowing, even with the most expert seedsman, where the lands or ridge are irregular or broader at one end than the other, a considerable waste of seed must always be the consequence; as when turning repeatedly on the same ridge, and at different parts, they cannot possibly scatter the seed with equal regularity as if it was of the same breadth,



and they could regulate their casts by the line of a particular furrow slice.

From the seed in this kind of sowing being scattered at random over the ground, and of course vegetating or coming up without any regularity on every part of the land, the crops cannot derive any great advantage in their growth by after culture, except in the way of clearing them from weeds by the hand, or some other similar means; but in other methods this is not the case, as they can be much improved by hoeing and other means.

It is probably from the ease and expedition with which crops are put in, in this mode, its requiring little knowledge or expense of machinery, and the business being capable of being performed in almost every variety of season, as well as circumstance of soil and preparation, that it prevails, in some measure, in most parts of the island. It is evident, however, that it is a less perfect, as well as less economical, method of practice in many respects, than those that are described below, as the seed can neither be deposited in the soil with the same exactness in regard to depth, regularity, or proportion, nor be so placed as that the crop may be improved in its growth by culture afterwards. It may, notwithstanding, be practised with propriety and advantage in cases where the nature of the land is such as not to admit the more perfect methods, either from their being so extremely strong and stony, or so very stiff and tenacious, as to greatly impede and disturb the progress and operation of the machinery which is employed, or from the state of the season being so wet as to prevent the land from being sown by such means. Thus in soils that abound much with stones; that are very stiff, wet, and clayey; and in all such probably as have been but recently broken up, and are not yet reduced by tillage to a state of considerable fineness in respect to their mold; this method must be had recourse to as being the most suitable and convenient. And there is another situation in which it must probably of necessity in many cases be practised; which is that in which the extent of ground cultivated under the drill system is so very extensive as to prevent a due attention being paid to the after-culture of the crops, by its interfering with the other necessary operations of the farm. In cases of this sort, as much depends upon the after-management where machinery is made use of, it will probably always be better to have such portions as cannot be properly attended to sown in the broadcast method.

In the drill method of sowing, the grain or seed is deposited, by means of some sort of machinery or other, in rows or drills at different distances according to the nature of the crop and the views of the farmer. It of course affords the means of distributing the seed with a much greater degree of exactness, both in respect to the depth and the regularity of the rows, by which the crops not only vegetate and grow up in a more equal manner, but by cultivation are capable of being more effectually assisted in their after-growth, and at the same time there is a considerable saving in the quantity of seed. And as the grain by such means is neither too thickly crowded together, nor too thinly scattered in the drills, there can



not be any injury in the weakness of the crops from the former cause, or loss from the too scanty number of stems and ears in the latter, which must always be more or less the case in the broadcast method of management. Besides, from the equality of the depth to which the seed is deposited in this way in addition to the advantages that have been just noticed, the crops become ripe in a more equal and uniform manner.

In the assisting of the growth of the crop by the frequent stirring and breaking of the earth about it, for a considerable part of the time it is upon the ground, benefits must also be derived in different ways. By turning the earth in different directions, the mold must become, not only more completely pulverised, but also newly and more fully aerated, in consequence of which various nutritious materials must be more abundantly provided\*; while, at the same time, the soil is rendered more easily penetrable by the superficial roots of the grain, and the power of tillering or sending forth new roots and stems increased, by the earth being laid up to such of the joints of the corn stems as are immediately above the surface. By this means the same advantages, are, indeed, in some measure obtained, as by transplanting and setting the roots of the plants deep in the earth, with considerable savings in the expense of labour. There are likewise other ways in which utility may be derived in this method of management, as by the more complete destruction of weeds that takes place, and the harvesting of the crops, in consequence of it, being accomplished with more certainty and less trouble and expense, as well as by the land being left in a more mellow and productive state for the growth of future crops.

But though this method of sowing seems to afford advantages in these different views, it has not by any means been generally adopted by agricultors, the reasons of which, as suggested by an ingenious writer, are the difficulty of bringing common labourers acquainted with the practice, the incorrectness of the machinery commonly employed in delivering the seed, and the expense with which it is at first attended; but there are others which have probably had an equal if not greater effect in retarding its progress, as the applying it to lands in an improper condition, both in respect to quality and the state of tillage, and the either wholly or partially neglecting the after-management of the crops, upon which, it is obvious, much must depend. It is probable also, that by attempting too great savings in the quantity of seed, and allowing it to be sown too thinly, both in respect to the drills and the distances of the rows, the practice may in many instances have been brought into disrepute. It is, however, sufficiently shewn by numerous comparative experiments, that where the nature of the ground and the state of tillage are such as to admit the implements to perform the business in a proper manner, and where a proper and regular attention is bestowed on the after-management of the crops, it is a method that has not only advantages in the ways that have been

\* Section on Fallowing of Land.



mentioned, but much superiority in the quantity and quality of the produce, as well as the more perfect tillage of the land.

The sorts of land on which this method of putting in the seed may be had recourse to with the greatest probability of success, are all those of the lighter and more mellow kinds, that are not so strong as to obstruct or impede the operation of the drill, and such of the heavy descriptions as have been brought into a state of tolerable fineness, and are not too wet or stiff to hinder the action of the machine; but it can probably seldom or ever be employed to much advantage, except, perhaps, for some particular sorts of crops, on those of the heavy and stiff, wet, clayey, kinds, as the operation must always be liable to be incompletely performed; nor on such as are of a very stony nature can it be made use of in a proper manner, as the stones will constantly be liable to derange the operation of the drill, and render the distribution of the seed irregular and incomplete.

In whatever kind of soil, and wherever the method of sowing by the drill is attempted, it will invariably be proper, besides suiting the crop to the quality of the soil, to proportion the quantity of seed to the nature of the land, and the distance of the rows to that of the crops, and likewise keep up a constant and minute regard to the culture of the crop during its growth. In this way, different distances in the rows and intervals have been recommended, according to the particular intentions of the agricultor. It is obvious that inconveniences must be experienced by their being either too large or too narrow, as in the former there must be a great loss of ground, and the latter little advantage can be derived in the culture of the crops, while growing. The nature of the land must probably have considerable influence in regard to the distance of the rows, and the manner of drilling. On the dry light sorts of soil, whether loamy, gravelly, or chalky, that can be constantly ploughed and kept upon the flat, as is the custom in the eastern parts of Kent, close drilling is probably to be preferred as the most advantageous. But on such soils as require ridging, somewhat wider distances may be proper. An ingenious enquirer on this subject found, that drilling three rows eleven or twelve inches asunder, on three-bout ridges, generally succeeded well. The three-bouts, in this way, form a ridge about four and a half feet in breadth; the three rows at the distance mentioned occupying two feet, and the horsehoe, passing on the side of each outside row, at the distance of three inches, leaves the ridge two and a half feet broad, and the intervals between the ridges about two feet. It is, however, further suggested, from remarking that in these cases the outside rows always afford the most vigorous and healthy plants, that two rows only, on two-bout ridges, would be equally productive, and leave the land in better condition. But, whatever may be the most applicable and most suitable distances, which experiment does not seem to have yet fully shewn, the very wide intervals of the early practice are to be avoided as improper for all sorts of grain crops, both on account of the loss that must unavoidably be sustained by the largeness of the spaces, and because the intervals, or spaces between rows, at much less distance,



can, in the improved methods of horse-hoeing, be stirred with equal facility and exactness.

For various kinds of green crops, such as cabbages, potatoes, and others of a similar nature, wide distances must obviously be the most proper. But the width of the intervals, and the proportion of seed, that have appeared the most eligible to an intelligent cultivator, after a practice of fourteen or fifteen years, are for wheat, rye, barley, oats, and vetches, on such soils as are not very wet, equidistant rows of one foot, on five or ten feet ridges. And for beans, peas, and turnips, on three-foot ridges, two rows on each, nine inches apart, with intervals of twenty-seven inches.

In respect to the proportion of seed, it is observed, that such lands as are in high tilth, and on five feet ridges, will only require three pecks of seed of either wheat or rye, five pecks of barley, oats, or vetches, and one bushel of beans or peas, to the acre. It is suggested, however, that these proportions should be varied, in the quantity of a peck to the acre, according to the quality of the seed, and the richness of the land.

It is remarked by another experienced driller, that in respect to wheat and barley, the distance of the rows and the quantity of seed must greatly depend on the quality of the soil. Where it is poor, the distance between the rows should not be more than about eight inches, nor the quantity of seed more than about nine pecks, being deposited to the depth of two inches and a half. If of a middling quality, the distance between the rows may be about nine inches, and the proportion of seed eight pecks; and where it is rich, the distance of the rows should not ever exceed ten inches, with a quantity of seed of about seven pecks. The latter sort of grain should also have a finer tilth, and not be placed so deep in the soil. As oats do not tiller so much as other grains, in drilling them a larger proportion of seed will be requisite.

It is likewise stated, that as beans and peas afford plants of a very succulent nature, they of course require a greater distance between the rows, and more especially as they are well suited to the horsehoeing method of culture. He has constantly found twenty-four inches to be the most advantageous distance for such crops, and the depth of about three inches.

In the sowing of turnips, rape, &c. on the poorer sorts of soils adapted to the growth of these plants, he has invariably found ten inches to be the properest distance, and on those of the richer description twelve. When they are sown at greater distances, he thinks they are apt to grow too large for keeping any great length of time. If sown at a wider distance, which may notwithstanding, be proper on such soils as are particularly rich, they should therefore be eaten off before the severe frosts set in, as large turnips are very liable to be destroyed by them.

In the putting in of carrot crops by the drill method, fourteen inches between the rows is recommended as the most proper distance, the land being slightly harrowed over after the drilling is finished.

There is considerable difficulty, however, in ascertaining the most proper and suitable distances in different cases, as they must of neces-



sity depend in a great measure upon the nature and state of the soil, as well as that of the crops.

It is obvious, however, that for grain crops, such as wheat, barley, &c. from the vast loss of ground that must take place, the great distances practised by Tull can seldom if ever be had recourse to with advantage. The experience of drillers in general seems indeed to have shewn, that on most sorts of soil that are suited to that method, and especially those of the light and dry kinds, the drilling in close rows, or at narrow distances, is by much the most beneficial mode. The distances between the rows, and the proportions of seed to the acre, that have been found by an experienced drill cultivator to afford the best and largest crops, are as below.

Kind of Soil.	WHEAT.		BARLEY.		OATS.		PEAS.	
	Quantity of Seed.	Distance between the rows.	Quantity of Seed.	Distance between the rows.	Quantity of Seed.	Distance between the rows.	Quantity of Seed.	Distance between the rows.
	Pecks.	Inches.	Pecks.	Inches.	Pecks.	Inches.	Pecks.	Inches.
Poorest	10	8	12	8	16	8	12	18
Poor	9	8	10	8	14	8	10	20
Rich	8	9	8	9	12	9	9	24
Richest	7	10	7	10	10	10	8	28

And from great experience it has been found, that for white corn crops nine inches answer extremely well, but that for pease, tares, turnips, and other similar crops, eleven inches is the distance that succeeds the best, and that for beans eighteen inches are not more than is necessary. It has likewise been found in respect to this last sort of crop, by others accustomed to the row system, that when drilled in two rows at nine inches, with an interval of twenty-seven, if weeded sufficiently early, and ploughed between in the method recommended by Mr. Cook, it becomes extremely thick and fine.

When clover or other grasses are grown, the practice of sowing them over the drilled barley crops, and covering them by the last hoeing, whether it be by the hand or horse, has been long since considered of much importance, and far superior to the usual method of rolling them in.

It is likewise evident that larger crops of barley may be procured by drilling with intervals of a foot, than by the broadcast method; a point that has been much doubted by some cultivators.

In regard to the implements that are employed for the purposes of drilling, they are various, according as they are intended for the preparation of the land, for the putting in of the seed, or for the cultivation of the crops afterwards. In those made use of for drilling, there is also considerable variety arising from the particular kind of crop that is to be sown\*. In the preparing of the land, and render-

\* Section on Implements.



ing it sufficiently fine to admit the operation of the drill, besides a common light *swing plough*, it will be necessary to be in possession of a *cultivator*; that which is constructed and sold by Mr. Cook, seems extremely well adapted to the purpose of breaking down and reducing the particles of stiff soils. It consists of a diagonal beam, into which are inserted a number of shares of different kinds, according to the use it is intended to serve, and from which, as has been already seen, it is differently denominated\*. It is capable of being employed with different numbers of tines or teeth as from three to seven, in proportion as the soil is in a clean or foul state, or is of a light or tenacious quality. It is also well contrived for affording at once a considerable degree of pulverisation to the soil, and at the same time of clearing it from the roots of weeds. It is stated by an intelligent cultivator, that as the chief desiderata in tilling land are those of pulverising, exposing, cleansing from weeds, and ridging up, in order to keep the land in a dry and healthy state, and for the purpose of sowing, they may every one of them, except the last, be fully attained at half the usual expense, by making use of the *tillage scarifier*. The surface weeds may be effectually eradicated and removed by skimming the land, by means of the broad shares or scufflers. The writer just mentioned also strongly recommends an implement which he terms a *fixed harrow*, as being capable without any other tool, of preparing lands that had been formed into ridges during the autumn or winter, for every sort of corn crop of the spring kind. This is found to pulverise and reduce the surfaces of such soils as have been exposed to the action of the frosts, to the depth of four or five inches, without bringing up the cold unproductive earth that lies below. The *extirpator*, described in the section on Implements, may likewise be employed for the same purposes with much advantage, as it is capable of reducing the superficial parts of the soil into a fine condition, to such depths as may be thought necessary, and at the same time of clearing it from weeds. It may be made use of on almost any sort of land; and, from the particular nature of its construction, is adapted to dispatch much work in a short space of time. When the land is of a stiff and lumpy, or cloddy nature, it may also frequently be necessary to have recourse to *shims*, in order to break down and separate the particles, and bring them into a less lumpy state.

In some parts of the county of Kent, where the seed is sometimes sown without a drill machine, an implement is often employed which they term a *striking plough*, by which little drills or channels are formed in the ground for the reception of the seed, about ten inches distant from each other, and at such depths as are thought necessary for the particular sort of crop that is to be sown. It is usually drawn by two horses, one before the other, with two men, turning at the head-lands alternately to the right and left. In order that the drills or channels may be parallel to each other, and of an equal distance, it is necessary to keep the inside wheel in the middle of the outside drill or channel. The work of from two to three acres

\* Section on Implements.



may, it is said, be performed in the course of a day with this tool.

The *drill roller* is likewise a tool applied for the same purposes, the rings with which it is surrounded forming the drills or channels in the ground. It may also, as has been seen\*, be made use of to reduce the lumpiness of soils.

There are a great number of machines of the drill kind in use, most of the drilling districts of the kingdom being possessed of particular kinds that are preferred by them.

An implement somewhat of this nature has been invented and used by Mr. Duckett, a very intelligent drill farmer, which has five shares, which strike out as many drills or channels, on ridges prepared for the purpose, in the ground, into which the seed is equally delivered from a sort of machine, termed a dropping box; or it may as in the above methods be broadcasted into the small furrows or drills made by the implement†.

A drill harrow, the invention of an ingenious agricultor‡, who has made many useful experiments in drill husbandry, from its great simplicity of construction would seem to deserve notice. It has somewhat the form of a triangular harrow, upon which are fixed two hoppers or seed boxes, the delivery of the grain or seed being performed by means of a fluted nut in the bottom of the hoppers, so adapted to the apertures as to work without the necessity of a brush. It is capable of sowing eight rows at a time, at nine inches distance. There is a double row of deliveries put in a diagonal position, to which motion is communicated by means of a wheel. This is effected merely by a new application of the universal joint. It is said to perform its work with much facility and exactness.

In addition to those that have been already mentioned as adapted to the drilling of bean, pea, and other similar crops, it may be necessary to observe, that there are different simple implements constructed for regularly depositing these sorts of seeds in drills or small furrows. In the county of Middlesex, we have seen drills of this sort made somewhat in the form of the very light sort of swing ploughs; but without a coulter, having a small kind of seed-hopper attached to the furrow side of the body of the plough, with the end of the axle of a small light wheel that runs on the landside, passing through the lowest part of it, and so contrived as to regulate the proportion of the seed according to the intentions of the person who has the management of it, and of being lifted up and prevented from sowing at pleasure. It may be drawn by one or two horses, according to the nature of the land. It is said to answer well, distributing the seed with much regularity and exactness.

Another implement that differs in some respects from the above, consists of a sort of barrow or hopper, fixed between the stilts or handles of a small swing-plough, which serves to draw the channel or furrow for the reception of the seed. The wheel, which in this drill is very small, runs in the track formed by the plough-head, but so close to it as not to be liable to be obstructed or put out of its

\* Section on Implements.

+ Ibid.

‡ Hutcheson Mure, esq.



course by the intervening of clods or lumps of earth, as is often the case in other machines. It is capable of being prevented from sowing at pleasure by the wheel being raised, which is easily performed by means of a small chain, which is attached by a pin to the right-hand stilt. The advantages of this application of the drill-barrow are asserted from actual trials to be, that while it is fully effectual in saving the labour of a person to wheel it, the seed is deposited in the most regular and exact manner. This method of working the implement, it is observed, has been first practised by Mr. Lyon, a farmer, at Wester-Drylow, in Mid-Lothian, on his own farm. It is likewise suggested that a roller for sowing turnip seed may be applied to the same implement. It may notwithstanding be observed that in all these sorts of drilling implements, one principal defect is, that of their only sowing or depositing one row at a time.

There is also a sort of small *drill-plough* that may be of much advantage in the cultivation of turnip and other crops of a similar nature, as it is so contrived that a much greater depth of cultivated soil may be provided for the reception of the roots of the plants, than in the usual methods, without the expense being in any way increased. In working it, one furrow is to be drawn straight the whole length of the field, and the proper proportion of dung being then placed in it, every subsequent turn or bout of the plough is said to form a new ridge, gather the dung, and bury it in the middle of it, and also make a drill, as well as deposit the seed in it, and afterwards cover it, forming every ridge equally of the same height, and similar in every other respect. In order to accomplish this in the most perfect way, the land should, however, it is observed, be in a fine state of tillage. The plants being set out to suitable distances by drawing a common hoe across the ridges, it will likewise, it is remarked, perform the business of hoeing in the most perfect and expeditious manner. It consists of a small wheel, with a seed box, which is fixed on a spindle at the end of the axle, and in this way delivers the seed at the distance which is required; the whole is attached to a very light swing-plough. Where the ridges have been previously formed with two boxes, one at each end of the spindle, two rows may be conveniently sown at a time. And if in the room of the hoe a plough with a double mold board be made use of, with the same apparatus, the ridge is formed at the same time that it is drilled, one box only being made use of in this case.

It has been suggested by an able cultivator who has had much experience in putting in different sorts of crops in the drill method, that in order to keep one hundred acres of arable land in high tilth, and regularly cropped, two Suffolk ploughs, one cultivator complete, one beam and handles, with only the tillage scarifiers, one fixed harrow, one drill with corn scarifiers, and a set of flat hoes, with five horses, would be required.

In addition to the above, it is probable that in particular cases some of the smaller sorts of drills, such as those constructed for putting in bean, pea, and turnip crops, might also be necessary, as it is often troublesome and inconvenient to employ the larger drills for such purposes. Where a great variety of crops are cultivated,



other sorts of hoes besides those of the flat kind will likewise frequently be requisite, as will be seen when we come to speak of the nature of hoeing, and the kinds of implements best suited to the purpose in different cases.

There is still another method of putting the seed into the ground, besides those that have been already noticed, and which is certainly both simple and exact when attentively performed; but which, since drill machines have been brought to a greater degree of perfection, as it requires a great number of labourers, can probably be only employed to advantage in populous districts, and where the value of labour is not high. This is that of dibbling or setting the seed singly by the hand, a practice that was known and slightly employed at an early period of the art in this country, and which has lately been restored. It would seem to have been introduced into the county of Norfolk, where it has since been practised to a considerable extent, about twenty years since, by the cultivator of a small farm in the vicinity of Norwich. Since that time it has extended itself into different neighbouring districts, as those of the counties of Suffolk and Cambridge, and is also said to be practised in Lincolnshire, with success. In this mode of putting the grain in, it is usual where the land is of the light and mellow kind, to pass a roller over it, before the business of planting is begun; the labourer then, with a small iron-pointed dibble, about three feet in length, in each hand, makes in moving backwards two rows of holes in each furrow slice that has been turned up by the plough, at from four to six inches distant from each other, according to the circumstances of the case, and about two or three inches apart in the rows, having the depth of from one to two inches. The person who is employed in making these holes is then followed by others who drop one, two, or three grains into each hole, as it may suit the intentions of the planter. This part of the work is mostly performed by women and children. The whole is completed by running a bush or light common harrow over the field. In this way an expert dibbler, with three active assistants, is capable of setting half an acre of wheat, and three quarters of an acre of barley, oats, or pease, a day. For wheat, in some districts, a narrow set plough of only seven inches width at bottom, is used to plough with; a one-horse roll then follows to level the flag, or furrow for the dibblers, who strike only one row upon each: when the wheat is deposited, *two or three kernels in each hole*; a two-horse roll follows, and afterwards the harrows twice in a place; when the field is finished in this manner, it is harrowed up again obliquely: by this method the wheat is deposited in the middle of the flag, at nine inches distance in the rows; and when come up, has the appearance of being drilled; the two-horse roller is supposed of material use in closing up the holes, and preventing the wheat from being disturbed by harrowing; and the land is made so solid by rolling, that very little apprehensions are entertained about the slug or worm. If there should be occasion to hoe in the spring, the operation can be easily and cheaply performed. Bush-harrowing is supposed of very little use; as it can only sweep the dust or light mold over the holes, and



in the first shower of rain that follows most of them will be seen, and much of the wheat be swelled out of them.

For peas, beans, or other similar crops, it will obviously be necessary to have larger spaces between the rows, and greater distances in them, which must render a larger portion of ground capable of being planted in a given time. When the children engaged in performing the work of dropping the seed into the holes, are only able to drop into one hole, six are required to follow one dibbler; when capable of dropping into two holes, three are sufficient for one dibbler; and where they can drop into three holes, two are only requisite for a dibbler. The wages are various according to these circumstances; for those who perform in the first manner, it is generally three pence a-day for each child, in the second it is seven pence, and in the third about ten-pence halfpenny.

Four men to perform the business of dibbling, with a suitable number of droppers, are considered as sufficient to work in one party, which is a much better practice than that of allowing the whole to work together, as the seed is set with much greater regularity and exactness.

The expense of performing the business of planting in this manner, is generally about nine or ten shillings an acre for wheat, eight for barley and oats, and seven for peas or vetches; but this must evidently be liable to considerable variation, according as the situation is populous, and the price of labour cheap, or the contrary.

In some of the dibbling districts, the difficulty and expense of the hand method have been attempted to be lessened by the use of machinery, such as rollers of the drill and spiked kind. The manual practice is, however, to be preferred where labourers can be procured. This circumstance of using implements for the purpose of putting in the corn, has probably led some to suppose that the practice of dibbling was more on the decline than is perhaps really the case.

The kinds of soil on which this method of putting in the seed has been practised with the most advantage, are the light and mixed sandy, and those of a loamy quality. On the deep stiff clays, it is seldom had recourse to. The newly broken up lands of almost all descriptions may, in most cases, be advantageously planted in this method.

Various sorts of crops have been found capable, in particular situations and circumstances, of being put into the ground in this way with advantage, such as those of wheat, barley, oats, peas, beans and vetches; the first is, however, the kind of crop for which it is the most commonly employed. Oats may, in many cases, be beneficially dibbled on such lands as have been newly ploughed up from leys. But it is supposed by some, that barley can seldom be dibbled, by reason the land is so dry in April that the holes will run in, and not stand open to receive the seed.

In the more southern parts of the kingdom, the most favourable season for putting in wheat, in this mode, has been found to be the latter end of September, or the beginning of October; the months of March and April for barley and oat crops; and for peas and beans as early in the spring months as the nature of the season will admit.



The quantity of seed that is required in this method of putting it into the ground, is considerably less than where the broadcast, or perhaps even the drill system, is followed; but the savings must constantly depend, in a great degree, upon the steadiness and accuracy of the persons employed in dropping the seed, and the number of the seeds that are put into each hole. It has been suggested by an experienced cultivator in this way, that where the droppers are properly attended to, the saving in wheat may be about six pecks in the acre, in barley eight, and in peas and vetches about four.

The number of grains that are deposited in each hole, is different in different circumstances, but the most general practice, and that which has been found the most successful, is three or four for grain crops, and one or two for those of peas, beans, and others of the same kind. It is evident, however, that they should neither be set too thickly, nor in too thin a manner: as in the former case the plants may be drawn up, and the crops in consequence become weak and not productive; and in the latter, as where only one grain is placed in each hole, they may be so thin as to afford but a scanty produce from the want of plants. Where due care has been taken in the putting in of the seed, there is mostly a considerable increase of produce in this way of sowing over the others. The exact amount of the additional produce that is thus obtained, has not, however, been fully shewn by the experiments of intelligent cultivators; but it has been supposed, in respect to wheat, to be from four to six bushels in the acre, and the result of an experiment made with the view of ascertaining the difference in the produce between sowing and setting barley, proves it to be still greater in that sort of grain, the experimenter having had twelve bushels on the acre more in the land that was dibbled, than that which was sown. Conclusions drawn from loose estimates, or single experiments, cannot, however, be depended upon, but it can scarcely be doubted that the quantity of produce is greater in the method of dibbling the seed than in sowing it broadcast. In the quality of the grain there is likewise a superiority: the wheat and barley produced in this way are said to be not only more free from dross, but larger in the kernel, and of course weighing considerably heavier. It is easy to perceive, that when the seed is put into the soil in the regular and equal manner that is the case in setting with the hand when well performed, the crops, of whatever kind they may be, may have a superiority in these different respects, both from the plants in such instances being less crowded together, and their becoming in consequence more strong and vigorous, and from the air and sun being more fully admitted, by which they become more equally, as well as more perfectly, ripened.

The practice of dibbling peas and beans is only met with in particular districts to any great extent. In the county of Gloucester, where it prevails in a considerable degree, the business is chiefly performed by women. In Middlesex and some other counties, both men and women are, however, employed in this sort of field work. In executing this operation with crops of these kinds, it is the custom in some places to form the rows across the ridges, but in others,



the lengthways of them. The latter method is probably the best, as the planters may be kept more perfectly distinct from each other, and the seed be put into the best part of the mold in the furrow slice, while in the former it must frequently be liable to be put into the loose earth in the seams or interstices formed by the furrow slices, and thus be provided with a less suitable bed for vegetating in. With some setters it is likewise a practice to make use of a line in order to guide them in placing the rows at equal distances, but those who have been much used to the business seldom find it necessary. In performing the work, the setters, beginning each at the end of a row, and forming holes at the distances of about two or three inches from each other, and of nearly the same depths, introduce one or two peas or beans into each hole; proceeding in the same manner until the whole is done. The intervals or distances between the rows are generally from about ten to fourteen or fifteen inches.

The proportion of seed that is requisite in this mode of sowing must obviously be different according to the number of seeds put into each hole, and the differences in the width of the intervals; but from two and a half to three bushels are the most usual quantities. The expense of this sort of labour is in most districts from about three shillings and six-pence to four shillings and six-pence, or five shillings, the acre. After the seed has been set, the field is mostly harrowed well over in order to cover it, by means of a light sort of harrow.

It would seem obvious from what has been observed on the different methods of putting seed into the ground, that each of them may possess a degree of merit, and be useful in particular cases and situations of soils and crops, but that in general the broadcast practice is probably liable to more objection than either that of drilling or dibbling, from its being less exact, and the seed being dispersed with such inequality, and in so irregular a manner, as to admit of little or no after-assistance being given to the crops during the period of their growth by hoeing or stirring of the more superficial parts of the soil about the roots of the plants. It must notwithstanding, be had recourse to probably in such cases and circumstances as have been already noticed; but wherever it is practised, as hoeing is in a great measure excluded, the land should obviously be in a good state of tilth, and as free as possible from the production of weeds; points that have in general been inadequately attended to in this system of arable management.

The method, by means of implements of the drill kind, in situations, and under circumstances of soil and preparation, where it is capable of being properly had recourse to, both from the seed being deposited with more exactness in respect to the depths and the regularity of the rows, as well as from the superior state of tilth that is requisite in the first instance, and its easily admitting of every kind of culture while the crops are growing, is certainly not only more perfect, but probably better calculated for the affording of full crops, and more adapted to the keeping of the land in the most advantageous condition for improved modes of cropping.



And the mode of setting or putting the seed into the soil by the hand, though probably less exact than that by the drill machine, except where particularly attended to, and certainly less capable of being beneficially employed from the greater expense which it incurs, may, notwithstanding, as it admits of after-culture, be found an useful practice in some cases, especially where the land has been broken up from clover, or any new ley, and is not too stiff or adhesive. It has, however, been suggested, that the method of sowing in drills is to be preferred, from the circumstance of a greater quantity of earth or mold being turned over, and consequently air included in larger proportions in the interstices, as in dibbling the sides of the holes are rendered more solid, and thereby less proper for the reception of the tender roots of the young plants.

In experiments made on two acres of a stiff hazel-coloured loamy soil, laid up in eleven-foot ridges, worth about twenty shillings an acre, and sown with oats, cole seed, barley, beans, and wheat, in the drill and broadcast methods alternately, in the rotation of first oats, second cole, third barley, fourth beans, and fifth wheat, the superiority of the drill system, over that of the broadcast, was found by Mr. Amos to be considerable, not less than from one pound to one pound fourteen shillings the acre in the grain and pulse crops, and one shilling and sixpence in that of the cole.

And on two acres of land ridged in the same way, but the soil of which was a light sandy loam, worth about eighteen shillings the acre, sown in the drill and broadcast manner with turnips, barley, clover, and wheat, in the rotation of first turnips, second barley, third red clover, fourth wheat; the trials of the same cultivator also turned out in favour of the drill method. The advantage in the turnip and clover crops being from eight to ten shillings and sixpence, and in those of the grain kinds, from seventeen shillings to one pound nine shillings.

On land where the soil was a light sandy loam, of the value of about twenty shillings the acre, managed in the method that has been just described, the crops being potatoes, barley, red clover, and wheat, in the course of first potatoes, second barley, third clover, fourth wheat, the superiority of the drill practice appears still more evident.

The value of the straw in all these experiments is supposed to be adequate to the expenses incurred in reaping, threshing, and conveying the produce to the markets.

It is likewise asserted, that in a variety of trials conducted in a similar manner, but on lands of very inferior qualities, as such as were not worth more than from twelve to fourteen shillings the acre a year, the advantages were never upon an average less than from twelve to fourteen shillings the acre annually in favour of the drill practice.

The advantage of the drill method of sowing even for grain crops, seems therefore to be placed by these experiments in a point of view that must tend to promote the practice; and for pease, beans, turnips, potatoes, cabbages, vetches, and many similar crops, it has long been almost generally considered as the most convenient and beneficial by those who have not supposed it adapted to grain,



But in respect to an increase in the produce on various descriptions of soil, such as those of the loamy and mellow, as well as the cold, clayey, and more stiff kinds, experiments which are asserted to have been made with much accuracy appear likewise from Mr. Cooke's statements to be in favour of the drill system. This was found to be the case in Mr. Boote's practice, when extended to more than three hundred and sixty acres, as well as in that of many other cultivators. Since the result of these trials were taken, the various improvements that have been made both in the machinery for the purpose of drilling the crops and those for hoeing and keeping them clean afterwards, must probably have contributed to render the differences in the quantities of produce under the different methods of sowing still more considerable.

The practical statements of a later experienced drill cultivator may, probably, on these accounts, be more satisfactory, and afford a more correct view of the superiority of the practice. The writer, after a slight trial with another drill machine, and becoming more acquainted with the nature of the drill culture from a more extensive observation of it in different places, determined upon making use of Mr. Cook's machine, and the method of management which he has recommended. He began by drilling in November 1791, two acres and a half of light, dry, loamy, land, not worth more than twelve shillings the acre, middling barley soil, broken up from the state of a foul, poor, pea stubble, with red lammas wheat, at the rate of one bushel to the acre, in rows with nine-inch intervals; another part of the field, confessedly better by five or six shillings the acre, being sown at the rate of two bushels to the acre in the broadcast method, and managed in the best manner of that practice. The crop of the broadcast sowing was, on account of the thinness of that of the drilled, it is said, much superior in its appearance during the winter and the early part of spring; but the other after being scarified once in March, and horse-hoed the last week in May, exhibited a decided superiority, the broadcast declining considerably; and that on the crops being reaped, that part under the drill system afforded nineteen bushels three pecks on the acre; while the part managed in the broadcast method did not produce quite five bushels on the same extent of land,

And in a second experiment on one acre of *potatow fallow*, of the annual value of about twenty shillings, prepared by being once ploughed and harrowed, and sown in March, in the drill mode, with one bushel of white lammas wheat; the plants when in double leaf being once scarified, and immediately afterwards, harrowed across with a common harrow, and after attaining the height of six or eight inches horse-hoed, the crop had also the appearance of being thin and slight till after midsummer; but the produce, on being reaped, both in grain and straw, was, notwithstanding, very considerable, being twenty-nine bushels three pecks, nine gallon measure.

In the spring of the same year, thirty acres of land of the value



of from thirty-five to forty shillings the acre, were tilled, manured, and prepared in every way in a similar manner: fifteen acres of which being drilled in rows at nine inches, with two bushels of seed to the acre, and fifteen acres broadcasted, with from three to four bushels the acre. During the growth of the crop, and at the time of cutting it, the season was extremely wet. The crop put in, in the latter method, was lodged, stained, and secured with great difficulty; while that in the former was scarcely lodged at all, and being clear from weeds was housed without injury, at half the extra expense of the other. The produce of grain was from ten to fifteen bushels the acre more in quantity and one shilling the bushel better in quality, although the broadcast crop had the advantage of being the first sown, which was a point upon which much depended that season.

And in a concluding experiment, a field of ten acres tilled, manured, and prepared for wheat, in every respect in a similar manner, except that half was drilled with one half the above proportion of seed at nine-inch intervals, and the other sown broadcast, doubts being entertained of the value of the land in different parts, two twelve-furrow ridges were, by way of proof, gathered through the middle of the part intended for drilling, the row sowing being commenced on each side of them. The two ridges were managed, both in respect to ploughing, sowing, and being weeded, in the manner of the common husbandry of the district. The drilled crop had one scarifying and horse-hoeing. At the period of harvest, the two ridges were first cut; and immediately afterwards a breadth equal to one of them, of the drilled, was cut on each side, and each part secured and kept separate till in a proper condition to be thrashed, when they were carted into different barns, thrashed out and winnowed; the drilled crop affording twenty-nine bushels three pecks, and the broadcast twenty bushels one peck. And that the experiment might be conducted with as much accuracy as possible, the same person was employed to winnow and measure the whole.

These experiments appear to have been made with so much exactness, and in so judicious a manner, that there can be little doubt of the results; and they have presented so favourable an idea of the practice to the writer, that he assures us he has ever since followed it for the whole of his crops, repeatedly sowing a part broadcast by way of proof; but that he has never once among all his trials seen the broadcast sowing equal the drilled part.

There is another point in which the superiority of the drill method of sowing is said to have a considerable superiority, which is in the saving of seed; but it is probable that in this way the advantages cannot, in general, be so great as the statements of cultivators under particular circumstances of soil and situation have made them. This would seem to be the case, from the observation so frequently made that those engaged in this method of practice generally continue to increase the quantity of seed in almost all descriptions of crops, and on most sorts of soil. The great differences in the details of expense under the different methods, as given by the very



intelligent practical agriculturist just mentioned, show, however, that much advantage may be derived in this way, where a correct attention is bestowed in the management.

There is reason to suppose that some proportions of seed may be more advantageous than others in regard to the quantity of produce, as it is obvious that injury must be sustained from crops being either too thin, or too much crowded together upon the ground. Few experiments have hitherto, indeed, been made with a view to the ascertaining of this matter; but the results of the few trials that have been attempted, seem to speak in favour of the drill method of only a middling proportion.

Numerous experiments have been described by writers on husbandry, in which the drill method has been shown to be greatly superior to that of the broadcast for various sorts of luxuriant vegetable crops, such as peas, beans, potatoes, cabbages, and even turnips in most cases. It has been observed by an attentive drill cultivator, that beans, when drilled in two rows, at nine inches, with an interval of twenty-seven, if weeded sufficiently early, and well ploughed between, become quite thick and abundantly productive. And, in planting a coarse piece of poor land in two different ways with potatoes, the one part in the common lazy-bed manner, and the other in drills of two rows at a foot asunder, and three-foot intervals between, for the purpose of being wrought by the common plough, and which were three times ploughed and once hand-hoed during the time the crop was in the ground; it was found, on the crops being taken up, that the part set in drills was by much the best, notwithstanding it had been planted with only about two thirds the quantity of seed. And it is asserted that, in the sowing of turnips by means of the drill, besides their being better, there is a saving of four shillings the acre in the after-culture of the crop when drilled at twelve inches apart, and an opportunity afforded of performing the business in a much more effectual manner. And the experiments of another cultivator of this useful root seem also to show that a greater weight of produce may be obtained by sowing in drills on one-bout ridges, at twenty-seven inches distance, than in the broadcast method, or even in drills, on a level surface, at twenty-one inches.

In regard to the practice of dibbling, though it may, as has been already observed, in particular cases and circumstances of soil and preparation, when correctly performed, have a degree of superiority over the broadcast method, from the circumstance of more air and moisture being admitted to the plants, and, where the custom of hoeing prevails, from the soil being more fully stirred; yet, from the expense and difficulty that attend it, and its being constantly liable to be performed in an improper manner, it would seem to be not only less advantageous than the drill method, but less capable of being generally applied.

But whatever may be the advantages of particular methods of sowing, or in whatever manner the crops may be put into the soil, it will constantly be necessary to attend to their being kept as perfectly clean and free from weeds as possible by some means or



other; as it is utterly impossible from the closeness and the want of free admission of air, as well as the great consumption of nourishment that must be daily drawn from the soil, in cases where such a number and variety of plants are suffered to vegetate together, that there can be abundant crops of grain if the business of eradicating them be either wholly neglected or only performed in a partial manner. Where the mode of putting in the seed will admit of it, care should be taken to have the intervals, or portions of ground between the rows, as frequently stirred as may be sufficient for affording the most full and perfect vegetation and ripening of the crops.

In the broadcast husbandry, from the plants standing in an irregular manner, the business of weeding and cleaning can only be performed by the hand with implements of either the forceps or hand-hoe kinds. But where the drill system, or that of dibbling, prevails, as there is more regularity in the state of the crops, this may be executed in other ways, and in a more easy, expeditious, and effectual manner, by the use of horse-hoes, or other powerful implements of the same kind, drawn by horses.

*Hoeing.*—This is a process in which the soils, by being frequently stirred, broken down, and divided, while the crops are growing upon them, are rendered not only more suitable for affording such supplies of nourishment as may be necessary, but for providing and continuing that fine state or condition of the mould which is most adapted to their perfect growth. It is therefore, perhaps, one of the most useful and important operations in the practice of drill husbandry, and one that should never be neglected by those who are engaged in that sort of cultivation. It is a practice in which various advantageous changes are produced; the weeds that are injurious to the crops, are not only effectually eradicated and destroyed, but more abundant and more regular contributions of nourishment provided by the different new combinations of air, moisture, or other matters that must take place either within or upon the soil, in consequence of the mould being often turned over: and the crops, by being thus left in a clean and free situation, become more vigorous and healthy in their growth. The pulverisation thus effected, likewise leaves the lands in a more open and permeable condition for the reception of the rains and dews into their internal parts; and the fibrous roots of the plants are not so liable to be injured by the drying and cracking of the earth about them during hot seasons. There is also another effect produced by hoeing, that, in many cases, may be of great importance; which is, that, by throwing up the mould against the stems of the plants in the spring months, a great increase in the crops may be accomplished by the tillering or shooting out of new stems from the joints about the surface that are thus covered with earth, as happens in transplanting, and which has been well represented by a late ingenious writer. Besides, the land thus undergoes considerable preparation, and becomes in a more proper and suitable condition for the reception of succeeding crops. It is also extremely obvious that, in proportion as soils are kept in a loose, mellow, and pulverised state, they must be more readily and more fully imbued with the various matters that may fall upon them.



Thus the different substances that are precipitated, or come in contact with them, from the surrounding atmosphere, such as rain, snow, dew, air, &c. become more intimately and more abundantly blended, incorporated, and combined with each other, and with the mould, in such soils as are frequently stirred and rendered light and open by hoeing, than where they are suffered, by neglecting this process, to become hard, compact, and almost impenetrable. In such situations as where the ridges are high, they seldom, indeed, penetrate much below the surface, being too readily carried away by the effects of the sun and wind, from their stagnating there, and becoming much exposed to them.

From the great differences in the nature of soils, it is probable, however, that the process should be conducted somewhat differently. On the stiff, heavy, and loamy kinds of land, or such as are much inclined to throw up weeds, it may be more frequently necessary than on such as are light, thin, or sandy; as in the latter, especially in hot weather, much injury may be sustained by a too frequent exposure of the internal parts to the action of the sun and air, by the great exhalation of their moisture, and other beneficial properties.

It has been observed by a practical writer, that the land for the purpose of hoeing should neither be in too dry nor too moist a situation, but in middling condition, between these different extremes. But that on light and dry mellow soils the operation may be well performed at almost any time; while on the wet and stiff ones it can only be done to advantage in such seasons as render them the most ready to break and fall down into small particles: as if done when moist in any considerable degree, much injury instead of benefit may be produced. It may, indeed, be remarked, that on the sandy, gravelly, and all such soils as admit the moisture to readily filtrate and pass away through them, there can seldom or ever be any necessity for delaying the process of hoeing on account of the wetness of the land; though, in other cases, it is obvious that much attention must be paid to the situation of the ground, in this respect, before the operation be undertaken.

In respect to the methods of performing the work, it was advised, by the more early cultivators, in this way, and while the large spaces were employed, to hoe or turn the soil from the rows or ridges on which the plants grow in the first operation, and by thus forming a small ridge in the interval, to leave slight furrows or channels for the reception of the moisture and other matters of the atmosphere on the sides of the rows of plants, thereby exposing a large extent of surface to the action of the air. And it was conceived scarcely possible to perform the operation too deep, or come too near the rows or plants, so that they were not cut or rooted up; as by thus baring, and nearly exposing, the roots, no injury was supposed to be done. And it was further imagined that, in particular cases, as in exposed level situations, the little ridglets, by being thus raised, might afford shelter and protection to the rows of plants, and by keeping the roots freer from moisture, be less obnoxious to the effects of the frosts. It would seem, however, to be a better practice, and more conformable to that of garden culture, by which plants are made to grow



in the most perfect and luxuriant manner, to turn the earth up to the plants during the severity of such seasons, and thus more safely prevent the effects of high degrees of cold or frost upon them. As it is obvious that, by leaving little mold about their roots in the lighter descriptions of soil, they must be constantly exposed to danger from the crumbling down of what remains in the winter season; and, on those of a stiff quality, by the little channels being formed so near them, injury may be apprehended from the stagnation of moisture, and the great degrees of cold produced in consequence of it. In the spring those ridges, that had been formed in the middle of the intervals or spaces, were split up and turned back again to the plants, which, from the mellowness of the mold, produced by the action of the frosts upon them for such a length of time, was believed to afford more nourishment and support to the crops. The same state of mellowness and pulverisation may, in most sorts of soil, however, be effected without the risk of exposing the roots to danger, by a more frequent stirring of the soil, without forming ridglets in the intervals, so as to draw it away from the rows of the crops. And, in addition there may also in this way be injury from the breaking and dividing the fibres and small roots of the plants, the growth of the crops being thereby much checked and retarded.

Though it is probable that much of the advantage of the operation of hoeing may depend upon its being performed exactly at those periods in which the crops first begin to decline, and stand in need of assistance, no satisfactory experiments have, perhaps, yet been made with a view to ascertain the appearances in different cases with that degree of precision which is necessary to enable the cultivator to guard against such effects by commencing his operations.

It would seem, however, that the autumnal hoeings should be accomplished at sufficiently early periods for the crops to become firmly established in the soil against the winter sets in, and the spring ones so performed as that the growth of weeds may be prevented, and a fine state of soil be provided for the coronal roots of the plants to shoot into, as about March or April, according to circumstances. Thus, where wheat has been sown at such an early period as to admit of the soil being stirred by the hoe in the autumnal season, it should, it is said, constantly be accomplished some time before the winter frosts set in; as when delayed too long at such periods, by the ground about the roots of the plants being in this way made light, they may thereby be more liable to be thrown out of the ground during the thaws or heavy rains in the winter. But the second or spring hoeings must be executed at different periods, according to the wetness or dryness of the soil, and the nature, appearances, and forwardness of the crops; in general, however, the more early they can be done after the frosts have disappeared the better; provided the ground is sufficiently firm to admit the animals employed in performing the operation, without poaching the land and producing injury in that way. The different after hoeings must constantly be regulated by the particular circumstances of the soil and crops, and the judgment of the agricultor,



Both in regard to the most proper periods for the performance of the business, and the frequency of their being repeated. Three or four may, in general, be sufficient, where proper care has been taken in preparing land. It should, however, be constantly kept in view, that the vegetation of the weeds be never permitted to advance too far, so as, in any degree, to exhaust the land, or injure the crop, by their luxuriance and shade; nor the surface of the ground become too firm and hard, so as to impede the action of the dews, and the influence of the atmosphere; as, in particular soils, and very dry seasons, much injury may be sustained in these ways from the crops not being perfectly fed. And in this last intention it may even, in some cases, as where the soil has been considerably impoverished, be necessary to give a further stirring to the land at an advanced period, in order to supply fresh nourishment to bring them to perfection.

On strong and wet soils it may, in many cases, be likewise hazardous to delay the first or autumnal hoeing too long, as such lands may become too poachy and wet to work in a perfect manner.

Light harrowing and rolling may also frequently be practised with considerable advantage in breaking down and reducing the lumpiness of the mold before the business of spring hoeing is begun; but these operations must be directed by the judgment of the cultivator.

This sort of business must be performed in different methods, according to the particular circumstances of the crops. For grain or small seed crops, where drilled or set with narrow intervals or spaces, the operation of hoeing should be performed with hand-hoes, or such implements of the horse-hoe kind as have shares adapted to the distances between the rows. But for pulse crops of different kinds, and all such plants as are sown or set in rows with spaces of considerable extent, implements of larger dimensions and of greater strength may be more effectual.

The introduction of the use of the -handhoe for the stirring of the earth between the rows of such crops as were drilled or set at narrow distances, as from six or seven to nine or ten inches according to the kinds of crop, was for some time considered as a great improvement upon Mr. Tull's method of drilling or setting two rows near together, and leaving wide intervals of two or three feet between the different nearly-planted rows, for the purpose of being hoed with horse-hoes. The hand-hoes employed for narrow distances by an attentive and able agriculturist, in wheat and pea crops, are said to be about six inches wide, and those for barley about four. And, with implements of this kind, the superficial parts of the soil between the rows of grain are not only effectually turned over, and the weeds eradicated, but their growth prevented by the mold being heaped against the rising stems of the plants. The hand method has, however, by many ingenious cultivators, lately given way to that of hoeing several rows at a time, by means of horse-hoes contrived for the purpose; a method which is certainly less expensive, and much more expeditious, and in which the passage of the horse



amongst the plants, where that is necessary, is said to be of no material injury or inconvenience.

The advantage of this method over that of the hand-hoe must evidently be considerable from its much greater power in loosening the soil, and passing to a much greater depth, as well as in doing the work in a more regular and complete manner.

But where the process of hand-hoeing is in use, which we have seen to be often the case in districts where the drilling or dibbling of grain in rows at narrow distances is practised, various implements of the small hoe kind are employed. The old light square form of hand-hoe has now, in most cases of field husbandry, given way to those of a more weighty and effective construction, by which the business of hoeing, especially in light soils, is not only more quickly and less expensively performed, but the mold stirred to a much greater depth. By attending to the above principles, and those of accomplishing the operation on several rows at a time, an ingenious cultivator has lately contrived an useful tool of this sort, which hoes three rows at once, and is capable of being varied according to the purposes for which it is employed. In the first form, a fine tilth is said to be struck by it into drills for receiving any sort of seeds with much more readiness than by the ordinary method of striking with the corner of the common square hoe, along any line of direction, as when one drill is correctly opened, the rest must, of necessity, be made with exactness. This is made use of in an advancing posture; but it has another form which admits of its being drawn, the person using it moving backwards, the pressure being assisted by a rope or strap passing from that part of the handle where the hand is applied, round the body of the labourer. The third is so contrived, that trenches for potatoes, or other similar crops, can be readily made by it. It has likewise another mode of construction, in which a space is left in the middle, that allows of its passing on each side a row of any kind of plants with great facility, and without any danger of their being injured. Its construction may, however, be better understood by consulting plate LXXXII. in which *Fig. 1.* represents a *triangular hand-hoe*, which is found more useful in some cases than the common square hoe, especially in thinning out crops that stand very thick or close together. *Fig. 2.* is the representation of a *treble hoe* invented by the above cultivator, by which three rows are finished at a time, the person using it *advancing* in the common way. It weighs with the three hart-hoes 7lb. 9oz. and is capable of being used by a woman accustomed to the work. It is much more effectual in producing a fine tilth in the drills than the common hoe. *Fig. 3.* is another *treble hoe* for making drills, the shares being set for drawing, the operator going backwards; and in order to have more pressure without tiring the wrist, a rope is added, which, passing round the operator's body, draws from that place where the hand would have acted: the weight with two twelve-inch hoes is 7lb. 3oz. *Fig. 4.* shows the hoes as employed in making trenches in gardens, for the reception of manure in planting potatoes; which are formed very expeditiously by striking



HAND HOES.

Fig. 1.



Fig. 5.



Fig. 4.

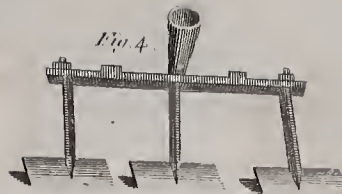


Fig. 3.

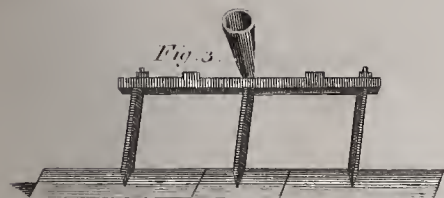


Fig. 6.

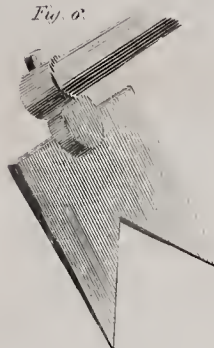


Fig. 2.

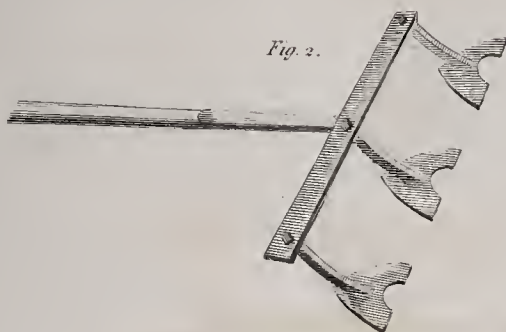
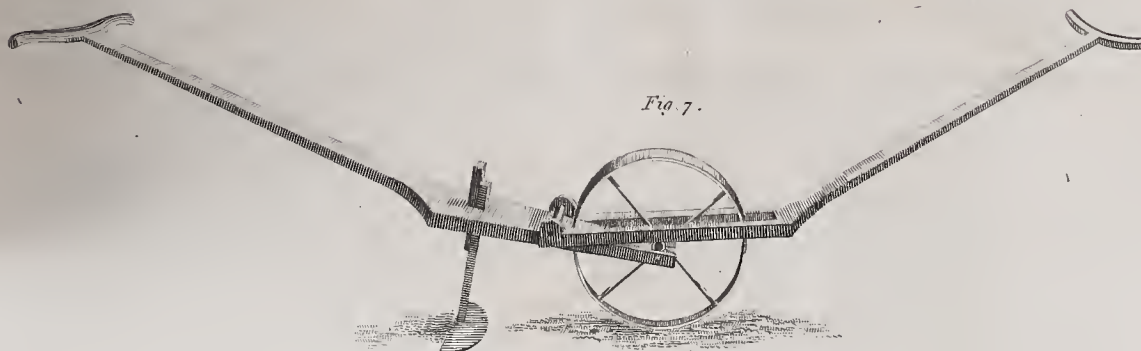


Fig. 7.









in a line; bringing the mould up into a half ridge, and then finishing it by turning and going back. It weighs with three straight six-inch hoes 6lb. 11oz. *Fig. 5.* exhibits the two outward hoes, a space being left in the middle for hoeing on each side a drill of any sort of plants with safety. It is asserted, that two acres of barley may be hoed in a day by means of this implement, and that good work may be made with it in oats and wheat. The breast-hoes have also been recommended, by some experienced agricultors, as more useful in hoeing grain crops sown in rows at narrow distances than those of the common kind, from their performing the work in a more perfect and expeditious manner. The triangular hand-hoe having the point of one of the angles downwards, has likewise been found of considerable utility in thinning and setting out crops, such as turnips, whether sown in the drill or broadcast method, as has been seen above.

It has been suggested, that the Portuguese hoe may be found extremely useful in the digging and cultivating of the land of steep mountainous districts, as well as in the forming of compost manures of lime and earth in the corners of fields where the plough cannot be made to perform the business, and in very hilly situations, where the spade cannot be easily employed. On head lands, in arable fields, and in orchards, or other plantations, for hand-digging it may likewise, it is supposed, be found of utility in different cases. At *fig. 6.* in Plate LXXXII. is represented a hand-hoe of this kind. *Fig. 7.* is the representation of a hoe invented by Mr. Mackdougall, which is drawn by a man before and directed by another behind; and is a very useful tool for hoeing crops that stand at sufficient distances in the rows.

The implements that are had recourse to where weeding the crops by hand-labour is practised, are very few, consisting principally of a sort of forceps, or tongs, that act on the principle of the lever, having handles of two or three feet in length, by which they are made to take hold, and force up different strong weeds, such as docks and thistles, that cannot be otherwise handled so as to be drawn up and completely removed.

The hand and breast-hoes being seldom sufficiently effectual even on the lightest description of soils, from their not performing the business to a sufficient depth, those of the horse kind have become more general. Besides, those of the former sort being in every case disadvantageous in point of economy, from the circumstance of so much more work being capable of being performed by those where horses are employed, the latter are to be preferred in most instances where the nature of the soil and crop will admit of them. Some suppose that the great superiority of the horse-hoe is shewn by the fineness of the appearance of such crops as have been hoed in that way over those in which the hand method was employed; while, at the same time, it demonstrates that deep and complete stirring of the soil is in general to be preferred as the most beneficial for perfecting the growth of the crops.

In the hoeing of such crops as are drilled at small distances, the horse-hoe annexed to Mr. Cook's drill machine is an extremely con-



venient and effective implement on almost any soil\*. And for narrow intervals and mellow soils, the *expanding horse-hoe*, invented by Mr. Amos, and the *six-shared horse-hoe*, may be found very useful and effective implements. The former has much superiority in consequence of its expanding shares, by which it can be set to such distances as may be required within the limits of twelve and thirty inches, and, of course, be capable of stirring the ground in intervals of any distance between such extremes. It has been found useful in hoeing bean crops, whether drilled or sown in equidistant rows; and may likewise be applied in the hoeing of potatoe or cabbage crops, as it is capable of performing the business in a tolerably complete and expeditious manner. The harrow which is attached to it may be useful in particular cases, as where the land is disposed to throw up successive crops of weeds, and in the preparation of it for the reception of crops. The six-shared horse-hoe, from its being regulated in respect to the rows, may also be made use of for grain crops where the distance is but small, as nine inches. It may likewise be employed in the preparation of the more stiff, gravelly, and stony description of soils, or such as are infested with weeds, by substituting the coulter in the places of the triangular hoes. The coulters being so contrived as to cut and divide the upper parts of the earth at the same time that the inferior parts are effectually stirred. In the section on Implements various useful *Horse-Hoes* or *Shims* are represented. In forging the shares of all shims, Mr. Young well observes, that the blacksmith should be careful to give them tendency enough *into* the ground, bending them downwards: for want of this caution he has found many of them to work badly; the wheel in the beam counteracts this tendency sufficiently.

But for performing the business, in particular cases, the use of a small *Rotheram plough*, or a common plough of any district, made upon a small scale, with a broad sharp share, is advised: on stiff soils, where the nature of the crops will admit of wide intervals, he thinks such sorts of ploughs preferable to all other kinds of hoeing implements; as they can be made to go to any depth required, and be wrought very near the rows, at the expense of merely the labour of one horse where the soil is of the light kind, and in a fine state of tillage. And another description of plough that may be of great utility in this business in earthing up the rows of plants on each side at once, is that with two expanding mold-boards, as by this means much work can not only be expeditiously performed, but the mold laid up to such heights as may be thought the most advantageous to the plants. And it is maintained by an able writer on rural economy, that all the different operations of the horse-hoeing kind may be effected by means of the common *swing-plough*, and in a much more complete and perfect manner, than by the assistance of the hoe or double-mold-boarded plough, which is commonly made use of for this sort of business.

*Rotation of Crops.*—The proper cropping of arable land is a matter of the utmost importance to the interests of the farmer, as upon it



in a great measure must depend the profits and advantages which he is to derive from his labour and industry. It is conceived by an experienced agricultor in the western part of the kingdom, to be “the most prominent feature in good farming;” and that by which the produce of the soil may be increased in a three-fold proportion. And by another; in a more southern district, as one of the most important subjects that can occupy the attention or exercise the ingenuity and skill of the agriculturist.

That it demands much regard by the cultivator is fully evinced by the great advantages that have been gained by it within the last twenty or thirty years, since its principles have become more perfectly understood, and more extensively applied. It has, indeed, been well remarked, that wherever either very good or very bad husbandry is found on arable land; it results more from the right or wrong arrangement of crops than from any other circumstance. And that no district is well cultivated under bad rotations, while it is exceedingly rare to see any badly managed under good ones.

In the arrangement of this business, as it has been seen that different sorts of plants or crops may not only require different kinds and proportions of nutritious materials to be drawn from the earth for their increase and perfect growth, but also different situations and conditions of soil: it must be necessary to adapt them, as much as possible, to the peculiar qualities of the soil, as well as the state of the land, and the nature of the climate in which it is placed: and as, on the same principles, some sorts of crops may exhaust or deteriorate the soils on which they grow in much less proportions than others, as is well known to be the case with many kinds of what are termed *green* crops, when compared with those of the *white*, or corn kind, it will be requisite to alternate or interpose them in such a manner, as that the ground may sustain the least possible injury in that way. In addition to these, it may likewise be of great utility to attend to other circumstances, as those of introducing such sorts of green crops as are most suited by the shade of their leaves and the kind of culture which they require while growing, for keeping the ground clean from weeds, and in a mellow and suitable state for the reception of the more valuable kinds of grain crops, as in this way the necessity of having recourse to the uneconomical process of fallowing may be considerably lessened.

And as most sorts of soils, when continued for any great length of time, either under grain or grass, are liable to sustain injury, and become less capable of producing full crops;—in the first case, probably from the carbonaceous principle being too greatly exhausted; and in the latter, from the occurrence of moss, or other noxious vegetable productions, that establish themselves in consequence of the weak and imperfect growth of the grass plants;—it may be proper to occasionally alter and change the nature of their crops, by keeping them for a while, after being broken up from grass, under the plough, and then restoring them again to the state of grass; as, in this way, the deficient principles may probably be the most



readily supplied where manure, in sufficient quantities, cannot be procured, and the injurious vegetable products be the most effectually removed.

It is likewise to be constantly kept in view, in directing the modes of cropping lands, that such an intermixture of green, root, pea, bean, and grain crops be grown, as will not only be best adapted to keep the soil in the most perfect order, but suit the demands of the agricultor, for the purposes of sale, as well as the keeping of such numbers of different sorts of live stock as may be proportionate to, the supplying of those quantities of manure that may be requisite for preserving the farm in the most perfect condition.

In regulating the courses of crops on all descriptions of land, with the view of preventing their exhausting the soil, it will be necessary to guard against the occurrence of grain, potatoe, or other crops of a similar kind in succession, as the result of experiments attentively made, as well as the experience of the most correct agricultors, in different districts, have decidedly shown their effects to be very powerful when employed in such a manner, in deteriorating and lessening the productive powers of the ground.

The injurious consequences of cropping land with grain, and other sorts of crops, that exhaust in a high degree, may probably be prevented in the best manner on the more stiff and retentive sorts of land, whether of the clayey or loamy kinds, by the interposing of bean and clover, or tare crops, between them, as experiment has shown the former to possess the power of ameliorating the condition of such soils; and the latter seems not less calculated for the same purpose, as it is known to grow well on these sorts of land: and on those of a more light and dry quality, whether sandy or of a gravelly nature, the intermixing of turnip, pea, and other crops of the same sort, with those of corn, may be equally successful. In many cases, especially on the more heavy kinds of soil, it may be necessary and highly beneficial to take two green crops for one of grain. This is a practice, which is found advantageous, and which has extended itself over a considerable tract of land with great success in the county of Middlesex; and by which, from the cleanness of the cultivation, and the great vigour of the land, in consequence of the few corn crops, the grain is found of a superior quality. It is indeed remarked by a writer of considerable experience, that land under common circumstances will not even bear, without injury, a corn crop every two years. This is fully shown, he conceives, by the turnip crops in Norfolk being uniformly found to be not only less certain, but much lighter than formerly, as well as from the same remark being applicable to the clover, and probably to the corn crops. Such diminutions in the quantity of produce, he supposes, demonstrate that the valuable and favourite rotation of that district, as turnips, barley, clover, wheat, is somewhat more than the ground can sustain, as it appears to be gradually sinking under too much exhaustion. With the aid of extensive sheep-walks, he thinks the soil not even able to support the depression.



of the present course of crops, especially when a five years' course, by introducing barley after wheat, is injudiciously had recourse to.

On inclosed lands, of different kinds, the same author recommends the following courses as the most proper: For the best sorts of land, alternate green and white crops; for such as are of a full medium quality, three green crops for two of the grain or white kind; for ordinary land, two green for one of the corn sort; and for the worst or that which is most exhausted, as downs and sheep-walks, three green crops to one of the white or grain kind.

Cropping in these methods and proportions would, it is supposed, keep the lands perfectly free from weeds, and in a state of high culture, and, "*under such management, might be continued in perpetual aration with a constant succession of large products.*" Besides, the farmer, it is imagined, by adopting such a system, would not be idly flattered "*by a promising seed-time, and miserably disappointed by a scanty harvest, as is frequently the case; but, on the contrary, be sure (at least as far as depends on human means) of reaping a plentiful return for all his labour and expense.*"

Various arrangements of crops, comprehending different numbers of the green kind to those of grain, may be formed. The following are judiciously recommended by Mr. Middleton, and are in the proportions of from two to five of the former, to one of the latter:

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1st. Two green crops to one of corn. | 2d. Three green crops to one of corn. |
| Corn; (or) Peas;                     | Corn; (or) Corn;                      |
| Clover;                              | Clover;                               |
| Peas;                                | Peas;                                 |
|                                      | Turnips;                              |
|                                      | Beans.                                |

Which is four crops in three years.

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 3d. Four green crops to one of corn. | 4th. Five green crops to one of corn. |
| Tares;                               | Peas;                                 |
| Potatoes, or cole, for sheep feed;   | Beans;                                |
| Turnips;                             | Corn;                                 |
| Corn;                                | Clover;                               |
| Clover.                              | Tares;                                |
|                                      | Turnips.                              |

Making five crops in four years.

Making six crops in five years.

By inculcating and adopting such methods of cropping as the above, the danger of exhausting the fertility of the soil will not only be completely prevented, but the injurious consequences of weeds be guarded against, which cannot be the case where repeated grain crops are grown in succession, as the experiments detailed above sufficiently prove, and which are still further confirmed by the reports of different counties, that have been lately published under the directions of the Board of Agriculture.

The following has been suggested as a course well adapted to newly broken up lands, of the heavier and more wet kinds, from the profit of beans being considerable in all cases where the soil has not been exhausted, and from the circumstance of oats being a much more productive crop than either barley or wheat, while the grassy



material of the old sward is in a state of decay. The clover restoring the diminished fertility caused by the alternate bean and oat crop, which the beans in the eighth year would have no tendency to lessen, while the wheat, after two such ameliorating crops, could scarcely avoid being an abundant crop: 1, beans; 2, oats; 3, beans; 4, oats; 5, beans; 6, oats; 7, clover; 8, beans; 9, wheat. It is evident, however, that such repeated cropping with grain crops, although ameliorating ones may be interposed, must soon considerably reduce the fertility of the land, and of course can only be had recourse to while there is a large portion of vegetable matter undergoing decomposition in the soil.

And it is recommended as an improvement in the cropping of uninclined lands, where, from the circumstance of turnip and clover crops not being capable of being much grown, no perfect system of husbandry can be pursued, to adopt the following course: first year, barley; second year, clover, on as much as manure can be applied over to preserve the plants from sustaining injury by the closeness of the bite of sheep; the remainder in peas in the drill method, which should be twice hoed, being earthed up at the latter operation; third year, wheat; fourth, potatoes, or spring tares. When potatoes, they should be planted at so early a period, as that they may admit of being taken up about the time cattle are to be turned in. Where the soil is good, and sufficiently light, the early sort might probably be the most proper in such cases, especially in situations near large towns, where there is great demand for them.

It has been found, by the experience of different cultivators, that such lands as have had their fertility greatly reduced by injudicious modes of cropping with grain in too frequent succession, and which are thereby become foul, and in a bad condition, may often be restored by cropping for three or four years, in such courses as that what are termed green crops may enter in very large proportion with more profit, and as little difficulty, as by being laid to the state of pasture. In this view the crops may be clover for two years; then cole, tares, or turnips, the land being previously manured; afterwards beans or peas, the crops being kept perfectly clean by repeated hoeing; and lastly barley, or in some cases, perhaps, wheat, with such grass seeds as may be adapted to the nature of the soil. That this may be accomplished with great advantage in this way, there can scarcely be a doubt; since it has been proved by the experience of the most correct agricultors, that any determinate quantity of land when cropped with clover, tares, turnips, or other similar crops, will produce twice as much food as when in the state of grass.

In the common methods of cropping, on strong, wet, clayey, or stiff loamy soils, where it appears probable, as has been already seen, that the practice of a naked fallow may sometimes be required, it is the most improved custom to make it the preparation for the first grain crop, depending upon some sort of green one for those that follow, without repeating it; as in this way: 1, fallow; 2, barley; 3, clover; 4, wheat. Or where manure is in abundance, a preferable course in such cases may be; 1, fallow; 2, wheat; 3, beans.



4, barley; 5, clover; 6, wheat. But even on this description of soils it may be more advantageous to crop in this manner: 1, cabbages; beans, or peas; 2, barley, or oats; 3, clover; 4, wheat; or 1, cabbages; 2, oats; 3, beans; 4, wheat: or to begin with 1, beans; 2, wheat; 3, cabbages; 4, barley; 5, clover; 6, wheat. And even in particular cases, where there is good culture; 1, turnips; 2, oats; 3, vetches; 4, wheat.

In breaking up these soils from grass by paring and burning, the course may be: 1, cole; 2, beans; 3, wheat; 4, beans; 5, wheat. Tares, though properly objected to by some cultivators, as coming too late in the spring on such soils, may sometimes be beneficially introduced for the purpose of being eaten off by sheep, or mown green for horses, milch cows, young stock, and hogs. By these modes of cropping, with proper attention to the eating the green crops off, where it can be done without injury, or the removing of them to be consumed in the farm-yards, or other places, in order to the manure being afterwards applied, the land may not only be improved by being rendered more friable, rich, and mellow, but be kept clean and free from weeds.

But on the richer descriptions of loamy soils, as well as those of the sandy kind, it seems to be the practice of the most improved arable districts to make turnips the preparation for the barley crop, and clover that for wheat, in this way: 1, turnips; 2, barley; 3, clover; 4, wheat. In this course oats may sometimes be substituted for the barley: and, instead of the clover, tares, chicory, or some other sort of artificial grass seeds. When soils of this kind are broken up from the state of grass, and the process of paring and burning adopted, the course should be: 1, turnips; 2, barley; 3, clover; 4, wheat; 5, turnips; 6, barley; 7, clover; 8, wheat; 9, turnips; 10, barley. If the ground is to be kept in tillage only a short time, the most proper course may be: 1, turnips; 2, barley; 3, clover; 4, wheat; 5, turnips; 6, barley; with grass seeds.

But where the practice of paring and burning is not adopted, which is by no means so common, it may be the best method to begin by beans or peas dibbled, and then proceed in the same manner as above. In these cases the turnip and clover crops are always to be eaten off by sheep, or some other kind of stock.

In the more dry and light kinds of soils of this nature, pea crops may be introduced, especially those of the white sort dibbled as a first crop, then proceeding with the other crops in the above manner. Where potatoes are begun with, more of the replenishing crops will be required, on account of their greater deteriorating qualities.

On the merely sandy soils, in some districts, turnips are made the preparation for grass, as well as grain: and it is found that there are none of these soils so light, as that they will not afford such a crop. The course is commonly, 1, turnips; 2, barley; 3, grass seeds. The grasses in these cases are to be cultivated with a view to the feeding of sheep, consequently should be such as will stand for some length of time, as it is by no means a good practice to break up again too soon; the flocks fed upon the turnips during



the winter season not being provided with a due quantity of food on such *new* layers for their summer support.

It is remarked that in Suffolk, on the better lands of this sort, the layers are often planted with peas, by dibbling, to much advantage, after being broken up, without being fed with sheep in the summer. The succeeding crop of wheat being in such methods much larger, the following course is said to be an excellent one for such soils: 1, turnips; 2, barley; 3, trefoil and ray grass; 4, peas dibbled; 5, barley.

Where soils of this sort are poor, or partake of the nature of heaths or sheep walks, it may be the best practice in bringing them into arable cultivation, to, 1, pare and burn for turnips; 2, turnips; 3, barley, with grass seeds. If they are intended to be kept under the plough longer than this course, the turnip and barley, and grass crops, may be alternately repeated until the fifth or seventh year, or even longer, if it be thought necessary.

And as it is found that potatoes exhaust in a considerable degree, where they are adopted as the first crop; in breaking up such soils, they must be succeeded by ameliorating crops, such as turnips and grass, as in the preceding courses. Where these soils are poor, and of the light blowing kind, their tenacity must be increased by the application of clay in suitable proportions, and the feeding off the crops by sheep. But where these means cannot be adopted, the course recommended above will be the most proper.

The gravelly and flinty soils, when of the lighter kinds should be cropped in such a manner as may be the most effectual in preventing their moisture from being dissipated, and their fertility from being impaired. In these views two or more green crops may often be necessary for one of grain in the way that has been described above; or, 1, turnips; 2, barley; 3, clover; 4, wheat; 5, turnips; 6, barley, with grass seeds. Pease, tares, and cole, may also be introduced with great propriety in courses for these soils. Where flints abound, as hoeing cannot be practised with facility, it has been recommended by an experienced cultivator to sow the turnips thinly, and mix a portion of cole-seed with them, by which means an abundance of sheep food may be produced. The grain crops, especially those of the spring kind, should always on such sorts of soil, where sufficiently dry, be sown early, that they may cover the ground well before the hot season commences.

On the heavier descriptions of these soils, beans or peas may, however, frequently be made the preparatory crops for barley, or even wheat, in this way; 1, beans or peas; 2, barley; 3, clover; 4, wheat; and which may be still further varied by tares and turnips, according to the particular state of the land.

On the thinner kinds of chalky soils, and such old down lands as are become so unproductive of herbage as not to be capable of being continued in the state of sheep pasture, it may be the most advantageous method of cropping when brought into tillage to make turnips or some other luxuriant green crop, which, while it keeps the land clean, and produces a large proportion of green food for the support of sheep or other animals, is beneficial by preserving the moisture,



which in such sorts of soil is liable to be dissipated too quickly, the preparation for grain. In these intentions the course may be, 1, turnips; 2, barley; 3, clover; 4, wheat; or in some cases, as where seed weeds are liable to prevail much; two crops of turnips may be taken before any grain crop with utility and advantage. If it be intended to keep such lands longer in the state of tillage, two crops of turnips may be again grown after the wheat, which will leave the soil in a high state of preparation for barley, then saintfoin may be introduced, as affording an excellent pasture for sheep for several years. In these cases the turnip and clover crops must constantly be fed off by sheep, which should not be removed from the land during the whole of the time the crops are in consumption, such other kinds of dry food as may be necessary being conveyed to them. By these means the soil will be left in the best possible state for the growing of barley, without the trouble and expense that must otherwise be incurred for manure.

In some instances, as where the land is sufficiently mellow and friable, the mode of cropping may be, 1, pease; 2, oats; 3, turnips; 4, barley, with grass seeds; or if it be the intention of the cultivator to continue the course, he may proceed with turnips or peas as before, closing the rotation with saintfoin, as affording a pasture for sheep, for several years. By attention in cropping and managing lands of this nature, in the manner that has been just described, great improvements may be made, not only in rendering them capable of affording valuable grain crops, but as producing a much larger proportion of green food for the use of sheep and other animals.

In the cropping of peaty, moory, and fenny soils, after draining them of their injurious moisture, some difference must be made according as they are deep, or only possess a slight covering of the peaty matter. Where they are of the deeper kinds, it may be the most judicious practice to make turnips, potatoes, cabbages, cole, or such sorts of crops as produce much shade, and by preserving the moisture in the more superficial parts of the soil, promote its decomposition and decay, the preparation for grain. In this view the crops may be, 1, turnips, cabbages or cole; 2, oats; 3, turnips, cabbages or cole, as before; 4, oats; 5, clover; 6, wheat; 7, turnips, &c. as above; 8, oats, with grass seeds.

From the great exhausting property of potatoe crops, they have been objected to by some agricultors; but on soils of this kind, experience seems to shew them to be highly useful. When they are employed the course may be, 1, potatoes; 2, oats; 3, turnips, cole or cabbage; 4, the same; 5, oats, with grass seeds. In the northern parts of Scotland, on soils of this kind, the employing of potatoes as a first crop has been found to be by much the most certain and advantageous mode, the succeeding crops of oats being not only more certain, but greatly more abundant.

But on the thinner descriptions of these soils, as those of a moory and fenny nature, and where the subsoil is of the stiff and retentive kind, it may be the most proper practice to begin with cole, and make it the preparation for grain crops in this way; 1, cole; 2, oats; 3, cole; 4, oats; or, 1, cole; 2, oats; 3, beans with dung; 4, pota-



toes ; 5, wheat ; 6, cole ; 7, oats. But in this last method, as it is probably that by potatoes and wheat coming together there may be danger of the land being too much exhausted, it may be better to omit the potatoes and introduce beans in their stead, which we have seen to be an improving crop, in this way : 1, cole ; 2, oats, the land being dunged ; 3, beans ; 4, wheat ; 5, cole ; 6, oats. It would seem also that on some of these soils clover might be introduced with advantage as a preparation for the wheat crops. It is a matter of great consequence on such soils as these to have recourse to judicious modes of cropping, as the improvements made on lands of this kind by such means are, in general, much greater than in other cases.

In almost all the heavier sorts of land, where they are broken up from the state of old sward, it will be found that beans are by much the best crop to begin with, though oats are mostly sown, as the decay of the turfy or grassy matter is so favourable to their growth, that they seldom fail in such cases of affording an abundant crop. Besides, the bean crops in this way contribute to render the succeeding tillage more effectual, by the roots penetrating so deeply into the soil, and thus in many instances become an excellent preparation for wheat. On the lighter sorts of soil, peas might likewise in many cases be the most advantageous crop to begin with. And as in lands that have remained a great length of time in the state of sward, there may be danger of the first crops, after their being broken up, being injured by the ravages of worms and grubs, which are often found to exist in great abundance in them, it may be advisable, where they are much suspected, to adopt the practice of paring and burning, or of turning the grassy surface completely under, to some depth, by means of the trench-plough. The former is, however, by much the best practice, though the latter may be highly useful where the grass is coarse and cannot be easily removed. But where neither of these methods is thought adviseable, as beans are not so liable to be attacked, it may be proper to repeat them. It has also been suggested, that advantage may be gained in this view, by keeping such grass lands as are to be brought into tillage, as bare and closely fed by sheep and other animals as possible during the latter summer months, as by that means the fly may not be so much invited to deposit its ova, as where the grass is left of greater length.

Where the nature of the farm admits of the ground being cultivated under the alternate system of grass and corn, or in what is mostly termed convertible husbandry, which, when every circumstance is fully considered, is certainly a very advantageous method, it will be necessary in directing the course of crops not only to have regard to the particular quality of the land, but to the growing of such sorts of roots, plants or other productions, as may, while they contribute to clean, improve, and prepare the soil for the production of abundant grass crops, be the best adapted to the feeding, rearing, and maintaining of those kinds of live stock that are to be kept, and that may afford the most abundant and regular supplies at the different seasons when they are most wanted.

In this way the loamy, as well as the gravelly, fenny, and the



thinner kinds of peaty soils, may be managed to great profit ; as by their having many of the green crops fed off upon the land, much amelioration and improvement must be produced while in the state of tillage, that must be favourable for the production of grass, and by being occasionally laid to grass for a few years, and then thickly stocked with sheep or other animals, they must undergo an excellent preparation for being again brought into tillage. This sort of husbandry appears to be practised with great advantage in Northumberland, it having been found that, on the sandy and dry light loamy soils, excellent grain crops, especially oats, may be grown by the lands remaining three years under grass, closely eaten with sheep, which could never be done while they were managed according to their old method of practice.

Under this alternate system of husbandry, on the wetter and more stiff kinds of loamy soil, and where there is considerable fertility, the course may be, after breaking up, 1, beans or oats ; 2, turnips ; 3, barley ; 4, clover, and sometimes winter tares, according to circumstances ; 5, wheat ; 6, turnip ; 7, barley ; 8, grass seeds, to remain in the state of pasture for three, four, or more years, as may be found the most suitable ; or break up for, 1, oats ; 2, beans ; 3, wheat ; 4, fallow and grass for four or five years. But on those of the drier description, it may be more beneficial to begin with, 1, peas or turnips ; 2, barley ; 3, clover ; 4, wheat ; 5, turnips ; 6, barley, with grass seeds, to continue in the state of pasture for not less than three years ; or, in some cases, the cultivator may begin with oats, then turnips, and afterwards barley with seeds, to remain in the state of grass for three or more years. It may likewise be useful where much green food is required, or there is an apprehension of danger from the wire-worm or grubs, to begin with turnips or cabbages, as such crops mostly succeed well in such cases when the turf is well reduced and broken down by repeated harrowing, though not brought to a fine state of mould. In a well-cultivated district in the northern part of the kingdom, different modes of cropping are said to have been attempted in this view ; and that of 1, turnips ; 2, barley ; 3, clover ; 4, wheat, has been tried till there has been an evident falling off in the crops, especially in those of the green kind ; the only means of recovering the lands in such cases being that of letting them remain, after their being three years under the plough, an equal length of time in the state of grass ; “ by this mode,” it is observed, “ nature has time to prepare a sufficient *lea clod*, which, being turned up for the turnip fallow, will insure a vigorous crop of turnips, as it is well known they always flourish upon fresh land, or where they find the remains of a *lea clod*, to vegetate in.” And it is added, that the portion of ground “ that is kept in grass for three years, breeds and fattens such a number of sheep, as leave a considerable profit, probably equal to, if not more than, the arable crops. These, as well as many other facts of the same kind, shew, in the most clear manner, the great benefits that may be derived from the cultivating of lands under the convertible method of farming. But in order that the agricultor may draw from it the greatest possible advantage, he should be well acquainted with the nature and management of different sorts of live



stock, with the best means of combining them with arable cultivation, and the most ready and convenient methods of breeding, rearing, and fattening them, under such a connected system of husbandry.

It has been suggested to the cultivators of the lighter and more friable kinds of soils, or such as are proper for the growing of barley, that where the keeping of live stock is the principal object, the following crops, in nearly the order in which they stand, may be capable of supplying a continued succession of green food, of the best quality, in abundance all the year round; namely; water-meadows—rye-grass—rye, cut green—winter tares—clover, the first crop—spring tares—clover, the second crop—after grass of meadows; clovers and seeds of all sorts—turnips—cabbages—potatoes—cole—Swedish turnips—turnip-rooted cabbage. “Whoever,” says the intelligent writer, “will attend to the raising of the foregoing crops, on a scale proportioned to the size of his farm and the number of his *live stock*, need not be straitened from want of food for *them* at any time or season of the year. It is evident,” he thinks, “on a bare inspection of the list, that, considering the properties of the different plants, and the seasons when each of them is the most fit for use, they complete the circle of the year. It may,” says he, “perhaps be started as an objection, that many farms are without water-meadow:—very true; but then cole, Swedish turnip, and turnip-rooted cabbage, might be produced in such quantity as to be sufficient for consumption in March and April, during which months, and part of May, they are in the highest state of perfection. These might be assisted, or even superseded, by turnips, potatoes, carrots, parsnips, and even cabbages, all of which being gathered while in the greatest perfection, might be laid up in store-pies, for spring use. Water-meadows,” continues he, “afford a vast deal of food from the middle of March; rye-grass from the 1st of April; rye from the beginning of May; winter tares soon follow; then comes clover, the first crop; spring-tares; clover the second crop: and the after-grass of natural meadows, clover, &c.; which will continue in perfection for heavy cattle till early sown turnips are ready. Later sown turnips and cabbages will be sufficient till the end of February, without storing; about which time the cole, Swedish turnip, and turnip-rooted cabbage, will come in, and continue good through March and April, and even May, if needful.”

Where lands are to be restored to the state of grass after some time, if the hoeing system be practised in such a manner as that the different crops may be kept in a perfectly clean condition; and where the green kinds, such as those of turnips, pease, and beans, are put in on three-foot ridges, in double rows, and those of the cabbage sort on similar ridges, but in single rows; the following rotations have been suggested, by an experienced cultivator, as the most suited for any length of time to different sorts of soil.



Clay . . . . .	Turnips or Cabbages	Oats	Beans and Clover	Wheat	Turnips or Cabbages	Oats	Beans and Vetches	Wheat
Clayey loams . . . . .	Turnips or Cabbages	Oats	Clover	Wheat	Turnips or Cabbages	Barley	Beans	Wheat
Rich loams, or Sandy loams . . . . .	Turnips and Potatoes } Beans } Turnips }	Barley	Clover	Wheat	Beans	Barley	Pease	Wheat
		Barley	Pease Clover	Wheat Wheat	For any length of time Potatoes	Barley	Pease	Wheat
Peat earth . . . . .	Turnips	Barley	Clover	Wheat	Potatoes	Barley	Pease	Wheat
Chalky substratum	Turnips	Barley	Clover	Wheat	Potatoes but on this soil 10 acres in every 100 should be laid with saintfoin for 8 or 10 years.	Barley	Pease	Wheat
Gravels . . . . .	Turnips	Barley	Clover	Wheat	Potatoes	Barley	Pease	
Light lands . . . . .	Turnips	Barley	Clover & Rye-grass	Clover & Rye-grass	Clover and Rye-grass	Pease	Wheat or Rye	Wheat

On the whole, though no invariable rules can perhaps be laid down for the cropping of land, as much must constantly depend on soil, situation, climate, and other less important circumstances, the chief objects to be aimed at in this business would seem to be those of well adapting the crops to the nature of the lands and kinds of husbandry that are to be pursued, and that of alternating the green and root kinds with those of corn, in such a way as that the soil, while it remains the least possible time in an unproductive state, may be the least robbed of its fertility. In this manner the culture of the field may approach that of the garden, and the deteriorating effects of successive grain crops be guarded against, at



the same time that more abundant supplies of both human and cattle food are produced.

However desirable it may be, it is unquestionably a matter of much difficulty to point out such proportions of crops of different kinds as may be generally applicable to arable farms of different descriptions, as it is obvious that in every case a great deal must depend not only on soil, climate, and situation, in respect to markets, but on the kind of husbandry that is practised, as well as various other circumstances of a local nature. It would seem, however, that the leading principles in this business should be, that the extent of land in the state of natural and artificial grass be fully adequate to the support of such a number of live stock of different kinds as may be sufficient to supply such a proportion of manure as is necessary for keeping the portion of ground under grain, root, green, or other crops, in the most perfect heart and order. Hence the space of ground, to be conducted under grain, root, green, and other arable crops, must constantly be proportioned to the quantity of manure that can be raised by the keeping of different sorts of domestic animals, while the number of the last must be regulated by the amount of the food that can be procured from the grass and green cattle crops, which can be cultivated and preserved for their use during the winter season. Without considerable attention to these different circumstances, it must be impossible, except near large towns, where manures can be obtained at a reasonable rate, to cultivate land to the most advantage.

Where the convertible system of husbandry is practised, and the ground continued for only three years in tillage, and then laid down to grass for one, two, or more years, according to the circumstances of the case, the following may be a suitable and proportionate distribution of crops for a farm of about two hundred acres.

In states of grass	110 acres.
Under fallow crops	30
In grain crops	60
	— 200

The annual distribution of which may be in this way ;

In the state of old sward	20 acres.
Under artificial grasses, as clover, saintfoin, lucern, &c.	10
In the state of irrigation or preserved grass	5
Under different fallow crops	30
Under wheat and barley, in succession to the fallow crops	30
First year's crops of different grasses	25
Second ditto	25
Third ditto	25
In oat and other grain crops after breaking up the grass	30
	— 200

It is not to be supposed that the above method can be exactly followed in every case ; as circumstances may sometimes require a larger proportion of the land to be under grain, and at others under grass or green cattle crops, according to the facility with which manure can be obtained, or as live-stock is more the object of the cultivator.



In the well-cultivated parts of Yorkshire, the proportionate distribution of crops on a farm consisting of 150 acres, sixty of which were a dry turnip soil, and the remainder a mixed clayey gravel on a wet bottom.

Annual distribution of Crops.

Wheat	.	.	.	30 acres
Barley	.	.	.	20
Oats	.	.	.	14
Meadow-grass	.	.	.	7
Red clover	.	.	.	14
Pasture	.	.	.	45
Summer fallow and turnips	.	.	.	20
				<hr/>
				150

On a red greet, and water shaken soil, incumbent on clay. Extent 200 statute acres.

Annual distribution of Crops.

43 acres wheat being 15 acres after fallow.  
 15 acres after clover lea.  
 13 acres after oats.  
 16 acres barley after fallow.  
 10 acres oats.  
 14 acres beans and peas.  
 70 acres pasture and meadow.  
 16 acres clover.  
 31 acres summer fallow.

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200

On a farm, extent 78 statute acres, restricted to ploughing more than 40 acres, which is a dry gravelly soil.

Annual distribution of Crops.

18 acres wheat.  
 8 acres potatoes.  
 6 acres oats.  
 8 acres of peas, cabbages, &c.  
 27 acres pasture grass.  
 11 acres meadow loam.

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78

And on a farm where the soil was lime-stone, clay, and moor. Extent 139 statute acres.

Annual distribution of Crops.

Wheat	.	.	.	23 acres
Barley	.	.	.	9
Oats	.	.	.	23
Beans	.	.	.	5
Meadow	.	.	.	12
Fallow	.	.	.	20
Pasture	.	.	.	47
				<hr/>
				139



## SECTION XIII.

*Cultivation of Arable Land, Grain and Pulse Crops.*

**I**N the cultivation of most sorts of corn crops, it is essentially necessary that the soil should be reduced to a considerable degree of fineness, or what by writers on husbandry is termed tilth, as where this is not the case they can neither be so well provided with nourishment nor be kept sufficiently clean from weeds. There are also other reasons that demand the superficial parts of soils to be in a fine condition for the reception of grain crops, which are those of the tender roots of the young plants being thus rendered more capable of establishing themselves perfectly in the mould, and of drawing from it a more regular supply of food from the more equal diffusion of moisture that must take place. Besides, it is favourable in other ways; the seed is not only more perfectly but more equally covered, in consequence of which the vegetation of the grain is more equal and expeditious\*.

But, independent of the state of the soil in regard to tilth, it should be in a suitable situation in respect to dryness; as, where the seed is put in where there is too great a degree of moisture in the soil, it may sustain injury by becoming rotten before the vegetative process commences, as frequently happens to pea and other garden crops when put in during the winter months; and where the land is in too dry a state at the period of sowing the grain, injury may be sustained by the want of that degree of moisture which is necessary for perfect vegetation. Besides, under this last circumstance, it may be more liable to be destroyed by worms, grubs, or other insects. In these views the agricultor should therefore be equally attentive to the preparation of the land, and the state or condition, in which it may be cropped with the greatest chance of success.

*Wheat.*—This is a sort of crop which, from its being capable of sustaining the severity of winter in most cases without much injury, must be considered of a hardy nature. Of this kind of grain there are two distinct species cultivated in this country; the smooth or polled wheat, and that which has a rough or bearded ear. The first sort, of which there are many varieties, is by much the most cultivated, as it affords the finest kind of flour; but the latter, which is frequently termed *river* wheat, from its being capable of yielding a large produce on the more stiff and wet clayey sorts of soil, as well as from its being less liable to disease, and injury from wet when cut, is not unfrequently grown where such sorts of land prevail. The common wheat is most adapted to the dry and mellow kinds of soil, but may be cultivated on others where proper care is taken to keep the moisture from stagnating too much on the land.

\* Section on Fallowing of Land.



The bearded or rivet kind is likewise said, by some cultivators, to be the most suited to such kinds of rich land as have been newly broken up, where there may be danger of the crop lodging from too great luxuriance, as it possesses the property of a greater firmness of straw.

Among the numerous varieties of the smooth or polled kind of wheat, the white and the red are the most esteemed in general; the former affording the whitest flour, while the latter has the greater produce.

There is likewise another sort of this grain that may probably be cultivated to advantage in particular cases, as where the turnip system is much practised, or other sorts of green vegetables produced on an extensive scale for the winter support of animals, and where the situation is warm and early. This is the kind known to farmers by the name of *spring wheat*, from the circumstance of its being put into the ground at that period. The culture of this sort has, however, hitherto been introduced only in a partial manner.

The Rev. Dr. Pike, upon the conviction of many experiments, observes "that wheat will thrive as well and produce as full a crop, if sown in the spring, as if it had been committed to the ground the autumn before; and in many situations he is of opinion (where it is subject to much wet during the winter) the crop will be much better in quality and more abundant in quantity: "I have frequently sown," says he, "in the spring both the white and the Kentish red wheat, sometimes as late as the middle of March, and never had a crop fail that was sown at that time: nor have I ever found any considerable difference in the times when the autumnal and the spring crops ripened." And Dr. Wilkinson recommends the cultivation of spring-wheat, as a species of grain which, although sown so late as the 11th of May, he has found, by experience, to ripen with the autumnal wheat. And the result of his experience on the cultivation of it, is, 1. That it is a distinct species of wheat, as observed by Columella, Linnæus, and Ray. He has sown it in spring, at the same time, and in the same field, with common wheat. The common wheat failed, while the spring-wheat rose to a crop. 2dly, That being liable to be hurt by the frost, no advantage is gained by early sowing. That though the proper season may be about the middle of April, yet it may be sown so late as the 15th of May, as he found by experience last year, when, notwithstanding the unfavourable season, it ripened before barley sown at the same time, and on the same field, and was cut on the 20th of September, immediately after the autumn-sown wheat; the crop two quarters per acre. 3dly, That about two bushels may be the proper quantity of seed per acre; when drilled, less; his has been sown broad-cast. That the average produce may be about two quarters per acre, unless when sown after turnips fed off by sheep, when he has gained three quarters per acre. 4thly, That the average value may be about 1s. less per bushel than the common wheat. He sold this year the spring wheat at 10s. while 11s. was given for the common sort. 5thly, That being a smaller grain than the common wheat, it ripens earlier and with less sun: in a wet harvest, therefore, it dries sooner.



for grinding, as he experienced last year. That it receives but little injury from a wet summer and autumn, but will ripen earlier than barley in such a season. And, 6thly, That when harrowed in on autumn-sown wheat, in places where the crop has failed, it will ripen at the same time without injuring the sample; which would not be the case with either barley or oats. It may therefore, he thinks, on a large farm, deserve the attention of the husbandman, and be worth his while always to cultivate a small quantity, as the best means of restoring a thin wheat crop.—Magazan beans, when dibbled in, will answer the same purpose, but perhaps not equally well, as they may be longer in drying than the wheat. But though he recommends the *Triticum aestivum* as best adapted for spring culture, Dr. Pike thinks that in some northern parts of the island, where the common wheat is generally found to fail when sown in spring, it may probably be so: but continues his assertion that he has *rspeatedly* sown both the common red or Kentish wheat, and the white, *in the spring*, and had excellent crops.

Common wheat is a kind of grain found from experience to succeed in general to most advantage on such soils as are of the more deep, strong, and fertile nature; but where the superficial parts are not so stiff or adhesive as to be incapable of falling down or breaking into a fine state. It may, however, be grown on the lighter descriptions of land, and in many instances afford good crops, though it has been well remarked by a practical writer, that, when introduced on such soils as are very light, whether of the sandy, gravelly, or chalky kind, a practice too common in most districts where they prevail, great loss must be sustained in a national point of view, from such lands being more adapted to the production of other sorts of crops. This is the sort of grain most generally sown where the land has received the preparation of a complete summer fallowing; but it is probable that, except in particular kinds of land, as those of the stiff clayey nature, and under particular circumstances, as where they are moist, and have much tendency to the throwing up of weeds, it may be grown to much more advantage after many different kinds of green root and other crops. In this way it may be sown after clover, tares, peas, beans, turnips, potatoes, and many similar crops, according to the quality and the state of the land. In districts where the flax and hemp culture is practised, it may likewise in some cases be put in after such crops. Mr. Young considers well cultivated beans as the best preparation for this crop, and from experiment has found clover next, and then tares. In Norfolk, wheat is seldom sown after the preparation of a complete summer fallowing: there, wheats almost invariably succeed clover, unless a pea or bean crop be interposed, and the land is scarcely ever fallowed for it, except in the case of *bastard summer-tills*.

But in whatever method, or after whatever kind of crop, this sort of grain may be cultivated, the soil should constantly undergo that degree of preparation that may be sufficient, according to the particular circumstances of the land, to bring it into a state of considerable pulverization and mellowness, especially in the more superficial parts, as well as to prevent as much as possible the rising of weeds;



for, whoever has attended to the progress of this sort of crop in such lands as have been well broken down and reduced, and in such as have been left in a lumpy crude state at the time of sowing, will have found the difference to be very considerable. When this kind of crop is taken after clover, the land seldom undergoes more than one ploughing, which is mostly given immediately before the seed is sown. But as the grassy matter in many cases where this mode is adopted, is extremely apt to rise and injure the crops in the more early stages of their growth, it may be better to follow the practice adopted in some districts of using a skim-coultered plough,\* as by this contrivance the remains of the clover weeds and grassy material on the surface may be cut or skimmed off, and turned into the bottom of the furrow, where they are immediately covered with the loose mould from below, to such a depth that little or no inconvenience can be sustained from them, while the land is thus rendered more clean, and capable of being harrowed in a more perfect manner than where the common plough only is employed. Besides, perhaps a better bed of mould is turned up in this way for the seed to vegetate in, provided the furrow is not made of too great a depth and breadth, and remain some time before it be sown, which should constantly be attended to by the agricultor in preparing this sort of ground for wheat crops. But it is the custom of some places† where the land is often continued for nearly two seasons in the state of clover, to break them up about the latter end of June, in the second giving them two and sometimes three ploughings. Where the situation is favourable, and the weather turns out suitable for reducing the soil to a proper state of tilth, this may be an advantageous practice, as by such means great benefit may be obtained by cutting the grass in the beginning of the season in which it is to be ploughed up; but where circumstances of so favourable a nature do not occur, such a method of preparation must be less beneficial than that of giving only one ploughing.

It has been justly remarked, by an agricultor of considerable experience, that in cases where the clover crops have been such as to leave the land in a foul condition in respect to weeds, it would be highly improper to sow them with this sort of grain, as from its remaining for such a great length of time upon the ground, they may be liable to have their seeds perfectly evolved and brought into the state of vegetation. In such cases, he suggests it as more advantageous to have recourse to such sorts of crops as may require the frequent operation of hoeing during their growth.

Wheat crops sometimes succeed those of the pea kind; but this is a practice that may probably be pursued with the most propriety and success in those districts that are from the nature of their situation sufficiently early to admit of the land being fully cleaned and prepared by repeated ploughing and harrowing after such crops have

\* This purpose may be effected by any common plough, to the coulter of which an iron fin or plate is attached by means of a screw or rivet, at the distance of about four inches from the point.

† This is the practice in the counties of Norfolk and Warwick, according to the author of *Modern Agriculture*.



been removed, before the proper time of sowing such grain. But where they are so late as only to allow of the land being prepared by one ploughing before the period of sowing, it is supposed by some to be an extremely hazardous practice to attempt the culture of wheat after such crops, as unless the ground be in a high state of tilth, there is little chance of a good crop being produced. In Norfolk, however, they are in the constant habit of setting wheat upon a pea stubble with a single ploughing, and consider it very safe and excellent husbandry: the pea-crop ought to have been kept clean, and, after it is harvested, the haulm harrowed off. They never plough a bean stubble more than once.

It is the regular practice of some counties to cultivate beans and wheat alternately on the same land for some time. This is the case on the stronger kinds of soil in the county of Kent, on which it is found to answer in a very beneficial manner. And where wheat is only occasionally sown after such crops, as is the case in many districts, it is also frequently found an useful practice; but in all such cases the beans should be cultivated in drills at from twenty to thirty inches distance, in order that they may admit of being hand and horse hoed in the most perfect manner. If this method has been followed, and the business of hoeing during the growth of the crops effectually performed, the land may be sufficiently prepared for the succeeding wheat crops by once ploughing, as the soil, from being thus kept clean, and in high tilth, can scarcely fail of affording a good produce.

In the more early districts, and where the lands are preserved in good order by judicious modes of cropping, wheat may also be grown after beans, whether cultivated in the drill or broadcast system, with success, as there may be sufficient time to give the necessary preparation before the period of sowing; which cannot be the case, as has been seen, where they are late, and there is only time for once ploughing. In other places it is, however, found advantageous when this sort of crop is to be grown after either peas, beans, or tares, to plough the land in as light or shallow a manner as possible, and then harrow and rake out the roots and weeds, so as that they may be consumed on the ground in heaps; the field being after this formed into proper ridges for the reception of the seed by ploughing again a few inches deeper than at the first. And in some cases it is even harrowed after the second ploughing, and ploughed a third time.

Wheat is occasionally cultivated after turnip crops; and which may in many cases be practised to advantage on the heavier turnip soils, especially where they have been kept clean from weeds by repeated hoeing, and consumed upon the land, at such early periods as to admit of the ground being prepared by once ploughing in a light manner. The late crops on the lighter sorts of land may be more properly managed by sowing them with spring wheat, or leaving them for barley, for either of which they may be prepared by two or three shallow ploughings. Spring wheat in this mode of preparation has, in some cases, been found to approach that of the autumnal sowing.

Where this sort of crop is intended to be cultivated after potatoes,



which as they have a great tendency to lighten the soil in a very great degree; as well as to exhaust it, should never be the case on the lighter sorts of land in backward situations, or under any circumstances where a sufficient proportion of manure has not been applied for the potatoe crops, one light ploughing immediately before the seed is put in may be in most cases an adequate preparation, as where proper attention has been bestowed in the culture of such crops, the soil is generally left in a sufficiently fine condition. It has, indeed, been observed by an intelligent cultivator, that the cause of wheat not succeeding well after potatoe crops in many instances is, that, besides the land being rendered too light and porous by the growth and cultivation that are requisite for them, the wheat is more exposed to the injurious attacks of the grub, earth-worm, and other insects; and in some exposed situations, from the seed-time being too long protracted, the practice becomes obviously improper.

When put in after flax and hemp, as weeds are apt to rise, it is always proper that the land should be ploughed over two or three times, in order that a fine state of tilth may be produced. The custom of giving but one earth after such sorts of crops can seldom or ever insure an abundant produce.

Experience has shewn, in the most clear and satisfactory manner, that this sort of crop should never, where it can be avoided, be grown after other kinds of grain crop, as rye, barley, or oats; and that the manure should not be applied to it, but for such crops as may precede it. Where the contrary practice is adopted, the crop is not only liable to be injured by the rampant growth of weeds, but from its being more apt to be diseased.

Whatever the nature of the ground may be, or the kinds of crops that precede this sort of grain, the soil should be reduced to a pretty high degree of pulverisation, as under such circumstances the vegetation of the crop is not only more perfect and uniform, but, from the evenness of the surface, and compact state in which it is left, is more fit for affording support and protection to the roots of the plants, by allowing them to spread and extend themselves with greater readiness in the fine mould thus provided, as well as by its falling down more closely about them. It has, notwithstanding, been maintained by some agricultors, probably without sufficiently attending to the subject, that a rough or cloddy state of the surface is the most proper condition for the reception of this sort of crop, as the young plants are thereby better guarded against the effects of the severe cold that frequently occurs in the winter season. It is probable, however, that cold is seldom hurtful in any great degree to this sort of grain, except where combined with too much moisture, or where sudden frosts and thaws have the effect of rendering the superficial parts of the soil so light and open as to be incapable of affording a proper support for the roots of the young plants.

*Time of sowing.*—The exact periods at which this sort of grain may be put into the ground with the greatest chance of success, under different circumstances of soil and climate, have not yet, so far as we know, been fully ascertained by experiment. In addition



to the observations that have been already made in speaking of sowing in general, it may, however, be useful to remark, that the earlier the seed of the autumnal sowings can be put into the soil, the greater chance the young plants will have of being well established in the ground before the frosts take place, which we have just seen to be a circumstance on which the welfare of the crop in a great measure depends. Besides, the state of the land and that of the season, is much more favourable for the process of vegetation when the crop is put in at an early period, than when it is delayed to a late one: the state of the weather in the latter case often admitting of only a very languid and imperfect growth until the spring, by which the crop must be exposed to much danger from various causes. Indeed experience has abundantly shown that late sown wheats seldom succeed so well, or afford such plentiful crops as those that are put in early. But when sown too early, there may notwithstanding be danger of the crop running too much to straw, and consequently of the grain proving light in the ear. From the beginning of September to the middle, or even the end, of October, may probably be considered the most favourable for this business. This is, indeed, confirmed by the established practice of the most correct farmers in almost every district of the kingdom, where this sort of grain is grown.

The practice of putting in crops of this sort so late as the latter end of November and beginning of December frequently depends on the crops that precede them not being capable, from the lateness of the situation, or other causes, of being taken off so early as that the land may be made ready for the wheat crop in the proper time. This is often the case after peas, beans, tares, turnips, and other similar crops. In these cases, on the lighter sorts of soils, and where drill culture is employed, it may often be a more advisable practice to sow in the spring, as by such a delay the ground may be brought into a more perfect state of preparation than could be the case in sowing it so late in the winter.

*Seed.*—The quantity of seed that is to be made use of in different cases we have already seen to depend upon and be regulated by a variety of different circumstances, but in general from two to three bushels, according to the state of the soil, the nature of the climate, and the period in which it is put into the ground, may be esteemed the most suitable proportion for soils of a medium degree of fertility, under the broadcast method of husbandry; but where the drill system of culture is practised, a considerably less proportion may be sufficient for the purpose, as has been explained in a more full manner in speaking of the nature of sowing, or putting different sorts of grain crops into the earth.

In the drilling and dibbling methods of sowing, which are unquestionably the best, where they are performed with correctness, six pecks of seed is sufficient: in the latter mode two rows being put in on a flag, care being taken to have the land rolled, after having been ploughed a fortnight or more, and the seed dibbled in to a sufficient depth, without scattering, covering it in by bush harrowing. Where the lands have a known disposition to mildew, a



larger proportion of seed should be given, whatever the soil or season in which it is put in, may be. Much less seed is necessary in early than late sowings.

On the rich soils of Gloucestershire, the quantity generally sown has been stated to be about seven pecks; while in many other districts, as Yorkshire, it is from eight to twelve. Where the lands are in a suitable state of tillage for receiving crops of this grain, ten pecks have been advised by a practical writer as the medium proportion. Larger quantities are likewise frequently sown in the northern parts of the kingdom; but it is obvious, that, where such large proportions of seed are made use of, the plants must be liable to be drawn up too much, and the crops in consequence to become weak and imperfectly fed, as well as smaller in the size of the ears. There may also be disadvantages from making use of too small proportions of seed, from the ground not being properly covered with plants: but where care is taken in the after-culture of the crops, less danger is probably to be apprehended from this than the other extreme, as a great number of plants will be supplied by the tillering or shooting out of new stems from the joints about the surface, in consequence of the mould being laid up against them.

*After-culture.*—The manner in which the crop has been put into the ground, the state of the land, and the preparation on which it was sown, may produce some differences in the culture that is necessary while it is growing. In every case it must, however, be kept perfectly clean and free from weeds, either by means of the horse or hand-hoe, as they not only injure the crop in its growth, but lessen the value of the sample at the market. But the stirring of the mould on the surface among the plants may frequently be useful in other intentions besides that of preventing the growth of seed weeds; for, as in the heavy kinds of soil, that are most adapted to this grain, the most superficial parts are liable to become so hard baked as not to be easily penetrated by the new-formed or coronal roots of the plants in the early spring months, especially when they are very dry and have been preceded by much wet, loosening of the earth, by any means whatever, must be of considerable utility. This effect is generally shewn to have taken place by the appearance and progress of the crop, which becomes of an unhealthy yellow colour, and advances but little in its growth. In such cases it has been suggested that harrowing once, or oftener, in a place, may be of much service in the early spring months. Where the crops are thin and of feeble growth, this operation may produce beneficial effects, by affording a sort of earthing-up to the weak plants, and thereby promote a more vigorous growth, at the same time that a number of new shoots are sent off from the joints thus covered, and the crop, in consequence, rendered more full and abundant; and where the grain is too thick upon the ground, it may also be useful by drawing out and destroying many of the plants. It has likewise been suspected by an acute writer, that many of the root fibres, by being torn in the operation, may prevent the over luxuriance of the stem and leaves, and by that means promote the more early fructification of the plants.



The practice of scarifying the young wheats is an important part of the drill culture, which should constantly be performed in an effectual manner, and not later than March. Some have not supposed it so beneficial from not performing it at the proper time. Mr. Cook has contrived two implements for this use, a fixed harrow and scarifier, the former executing its work merely by common tines or teeth, having three rows, which, by varying the position diagonally, one, two, or three of them may be brought to act in the space of nine inches, without injury to the rows of wheat plants. "If two," Mr. Young says, "they may be drawn in a breadth of three inches: if three, in that of four inches, and these spaces widened at pleasure, but still so as to keep clear of the rows of wheat. By loading the harrow, the teeth are forced to a proper depth." And it is added, that "the scarifier has teeth of various breadths; but for working at this season, between nine and twelve inch rows, the narrowest, are to be preferred." By the action of these tools, the surface mould is loosened and the air admitted, being performed to the depth of two inches with safety, and without mould being raised, so as to cover or bury the plants, the earth being only loosened and not displaced. By these contrivances much work can be accomplished in a very short time, which is a circumstance of much consequence at this busy season.

Where this method of practice is not adopted, the drilled and dibbled crops, especially in the latter, where only one row is planted on a flag, must be hand-hoed in the intervals, which should be done the first time in the beginning of the above month, and a second time towards the end of it or a little later. Some likewise do it to the broadcast wheats, but this has been supposed injurious by many. The business of thistling the wheat crops should also be carefully performed in May, or the very early part of the following month.

Rolling the land, either without having recourse to the harrow or after it has been employed, especially where the surface is cloddy, and the operation is performed when the ground possesses a medium degree of moisture, may be of utility in the same way, as well as by forcing the roots of the wheat into the earth, and by that means causing new stems to rise. On all the light thin soils, when this sort of grain is cultivated upon them, much benefit may also be produced by the use of the roller, by the roots of the plants being thereby prevented from being so easily loosened and thrown out of the ground. And the same practice is recommended as generally useful where clover or grass seeds are sown with wheat crops, as a means of rendering vegetation more secure. The former operation may likewise be practised with advantage, in the way of preventing the destructive ravages of the worm.

In cases where the land is not in a sufficient state of fertility or preparation to bring the crops to perfection, it may be necessary to make use of top-dressings. Substances of both the solid and fluid kinds have been made use of for this purpose; the first consist chiefly of the dung of different sorts of birds after being brought into a powdery state, bone-dust, soot, peat-ashes, and various saline



matters. The latter are principally the drainings of dunghills and other similar liquid materials. The former should be thinly sown over the crops, with as much evenness as possible, as early in the spring as horses can be admitted upon the land without injury; and if it can be done when the weather is inclined to be moist, it is the better. A roller may then be passed over the crop with advantage. Where the latter substances are made use of, care should always be taken that the plants be not injured, by having too large a quantity of such fluids applied to them. In this practice the expense should be a primary consideration, and small trials first made where dungs are not to be used. The proper season is the middle of February\*.

The practice of transplanting wheat may be had recourse to in particular cases, probably with beneficial consequences, as where there are some parts of such crops too thickly set upon the ground, while others are too thin, irregular, or patchy, as by thinning and setting out the plants of such over-abundant parts among those that are deficient, much service may be done to each of them. The first will be rendered more capable of admitting the operation of the hoe, and thereby of supplying more abundant nourishment for the luxuriant vegetation of the plants; and the latter be supplied with the proper number of plants, which could not be accomplished in any other way. It has been suggested, that, when cultivated in the garden, one acre would be capable of affording sets for an hundred, when planted after being properly divided, at the distance of nine inches from each other, and as the business of transplanting is to be performed; in the spring, it is supposed that crops of this grain may be raised in this manner on lands that possess a greater degree of moisture than is suited to the healthy growth of wheat in general. Besides, clean crops may be produced in this way with much greater certainty, as where the ground is ploughed over just before the plants are set out, the grain may rise much quicker from the plants than the weeds from their seeds, and the crop, in this way, overpower such noxious plants. Many advantages of other kinds have been stated by other writers as the result of this practice. It is supposed that this business may be done at 13s. or 14s. an acre.

The feeding of wheat crops, where too forward or luxuriant in the early spring months, by means of sheep, is a practice that has been found of much benefit in many cases. The good effects in such instances are supposed to arise from the removal of the upright central stems, by which means different new lateral stems or root-scions are sent off or brought forward with more vigour, by the acquisition of a larger proportion of nutritious matter from the joints in consequence, that must otherwise have been exhausted in supporting the central stems.

This practice has been found by experience to be the most useful on such strong and fertile lands as are apt to produce a larger proportion of straw than can be properly supported. In these cases advantage has frequently been derived by feeding off the blade at two or more successive times; but in managing the business, great

\* See manuring of tillage lands.



care is necessary, to see that the whole is completed before the crop begins to spindle, otherwise more injury than good may be produced. But on the lighter and more poor descriptions of soil, the practice must be employed with great caution, as on such lands the growth of the crops may be so retarded, as to become weak and spindly. Besides, on those lands where they are very light, and the crops thin, injury may frequently be done, by many of the plants being pulled up on account of the closeness of the bite of the sheep. They should, therefore, never be suffered to remain upon the crops when the weather is wet and the surface of the ground much loosened, or after sudden frosts and thaws; as in such cases much harm may be done by the plants being pulled up and destroyed. The treading of the animals may, however, be of great service in all the light sorts of land, and where the crops are thin, as by that means the earth will not only be pressed more closely about the roots of the plants, but the stems in many instances so forced into the ground and covered up, that new shoots will be sent off laterally, and the crops be thus rendered more full on the land. But where the soils are very stiff and adhesive, the growth of the crops may be checked and retarded by the practice, and of course the shoots thus caused become weak, affording only small ears and light grain.

But though this practice has much relation to that employed in gardening, of stopping the growth of the main stems of some sorts of plants, as those of the cucumber and melon kinds, by rubbing off or cutting away the central buds, in order to expedite their fruiting; yet, in wheat crops, where the principal stems are eaten down, except when they are early and of very luxuriant growth, the ears of the new shoots may not have time to perfect their seed, and of course become light and shrivelled in the grain; and the new stems, from their weakness, be more apt to fall down and be lodged. These are circumstances that have been frequently observed to occur in the feeding down of wheat crops by means of sheep. The same philosophical writer also suggests that, in respect to the culture of wheat crops, the most beneficial method is that of promoting as much as possible the time of blossoming, while that of ripening is protracted, as it is for the farinaceous reservoir of nutriment deposited in the cotyledon of the new seed, in order to support the growth of the *corculum* or fresh embryo, that the plant is cultivated; which farinaceous deposition is effected in the interval between the blossoming and ripening of the corn, either before the impregnation of the pericarp or seed-vessels, or afterwards; and the weight and plumpness of the grain is thus augmented. The eating down of crops by sheep may therefore often be hurtful, by retarding the period of blossoming, as well as by restricting the growth of the stems. But besides the advantage derived from the feeding down of wheat crops with sheep, they may sometimes be employed with benefit in other views; for as the coronal parts of the roots of such crops are liable to be laid bare and exposed for some inches in length, about the surface of the earth, during severe frosty winters, the turning in of sheep upon them in such circumstances, when the ground is moist, and keeping them in motion,



may add to press them into the loose soil, and in that way produce new roots, as well as afford covering and protection to such as have been denudated. It is likewise a practice with some farmers, who contend that much advantage is derived from it, to turn sheep upon the crops where danger is apprehended from worms, slugs, or other insects; in order that, by keeping them constantly in motion, such animals may either be wholly destroyed, or so fixed in the surface mould as to cause their more gradual death.

There are many insects that are highly injurious to wheat crops in mild and open winters, as well as during the spring, and sometimes in the early summer months, by eating off and destroying the stems at the joints about the surface of the earth, which are in such parts sweet and tender, from their containing a portion of saccharine matter, and being of young growth. In such cases the blades of the wheat plants drop down and become withered, by which the crops are frequently in a great measure destroyed.

The principal of these destructive animals does not yet seem to have been described with sufficient correctness by writers on agriculture; it is, however, probable, that there may be different varieties of the same grub, that may be hurtful to grain crops. One kind of grub is asserted to be annually found in wet situations in larger or smaller quantities, according as the preceding season has been hot or cold: and that while it continues in the state of egg it cannot be injured by any severity of weather that may occur. Even in the grub state it is not capable of being much injured; and when in that of the fly it is equally hardy. The only period in which it appears to be susceptible of injury, is that of its transmutation from the grub to the *aurelia* state, in which stage it is capable of being destroyed by cold and wetness; and as this change mostly takes place some time about the end of May, or in the early part of June, at which times rain generally falls in abundance, the whole, except such as have secured themselves in dry hills of mould, in meadows, or the borders of ditches, are annually killed. On arable lands few or none are believed to escape to effect the purpose of propagating their kind, unless in such seasons as are unusually droughty during the time of their change into the *aurelia* state. Hence the rains that fall at such periods are not only beneficial in promoting the crop, but in destroying this sort of insect.

Besides this, it is observed in the same work that there are several other grubs brought forth at all seasons in dry lands, which are not less injurious to corn crops than that just described. They equally possess the power of resisting the hurtful effects of the weather in every stage but that in which they are changed into the *aurelia* state, when moisture and cold have the power of readily destroying them. The whole of the grubs that are produced on soils of the more dry kind are said to be of the moth tribe.

It is added, that the grub, when the autumn has been mild and warm, is brought into existence about the latter end of October, and proceeds in its growth as long as vegetation continues in any degree; after which, probably from the want of food, it seems to remain at a stand till the spring season, when its ravages soon become evident.



It begins to increase in size towards the end of February, and continues to grow till the early part of May, when it is often more than an inch in length, and one third of an inch or more in circumference. It is said to be then extremely destructive, eating through the roots of the strongest stems of corn plants in a very quick manner. And it is stated, that on taking one of them, and putting it into earth, consisting of a soft black loam, about mid-day, covering it well, at the root of a plant of oats that had sent out thirty-seven off-sets, and which had been well earthed up, the plant on being examined about the same time the succeeding day, was found to have its leaves hanging down in a declining state, and the root, with the whole of the off-sets, so injured as to be utterly incapable of recovery.

It has been found that the grub commits its principal injury on corn crops just after the germination or sprouting of the grain, by devouring or eating away the young shoot before it shows itself above the ground. When the plants are up above the surface, and have acquired considerable substance, there is much less danger from the ravages of these animals, except where they are very numerous. During the day they are said to be mostly found from half an inch to an inch and a half below the surface; and they are not supposed to come much above the ground during the night.

Various means have been suggested for the purpose of destroying these animals, and preventing their ravages on grain crops, but hitherto probably without much success. The substances that have been chiefly employed in this intention are lime and saline matters; but it is probable that neither of them are fully effectual in preventing the destructive ravages that are often experienced from such animals, as it has been found by experiment that the mixing of such materials, especially the lime with earth, by which it is soon saturated, does not prevent them from propagating and continuing in the mould, and consequently has but little effect in preserving crops from their attacks. But though lime, when combined with the mould of soils, so as to become perfectly effete by the absorption of carbonic acid both from it and the atmosphere, may not have much power in destroying the grub: there can be little doubt, that when applied in its caustic or most active state, it will prove destructive to it, as well as most other animals of the insect kind. It has indeed been remarked, that both hot lime and alkaline salts are capable of destroying such noxious insects as feed upon the roots, stems, and leaves of field plants, by the property they possess of combining with and reducing the organization of their bodies. This effect would not however seem to be produced on living animals, except where such substances are laid on in very large proportions, by which the crops would be in danger of being destroyed. It is added, that neutral salts may often be made use of with success in the same intentions. These are supposed to produce their destructive effects on snails, slugs, grubs, and other similar animals, by causing such excessive evacuations, by their powerful action, that they are incapable of withstanding them. In this view it is probable that, in the neighbourhood of the sea, such sand as has been constantly for a long time covered by the tides might be employed with advantage in the way of a top-dressing where wheat



or other crops are injured by such animals. But when either caustic lime or sea-salt is laid on in the way of top-dressing for grain crops, in order to destroy the grub, when existing at their roots, immediately below the surface of the ground, great care should be taken that they be not possessed of such causticity, or applied in such quantities, or so unevenly, as to hurt the young plants by their too powerful operation on them.

Soot is likewise a saline substance that has been much made use of in different districts for sowing over young wheat and other grain crops when injured by worms, grubs, or other insects that feed upon and destroy the tender stems, leaves, and roots of such plants. It is a material which, in addition to carbonaceous and earthy matters, consists of mineral or resinous oil made capable of solution in water by the large proportion of saline substance which it contains. The solution thus formed, it is asserted, “is an extremely bitter, high coloured, oily liquor, which not only poisons the insects on which it may fall, but also communicates a bitter taste to the surface of the roots and leaves of plants, thus rendering them unfit for the food of such insects.” But the effects of this substance may be useful in other ways besides that of destroying insects; the growth of the plants may be so quickly promoted by the bituminous oily solution formed by the saline principle of the soot, as to allow no time for the ravages of the insects on them.

It has also been suggested, that where the grub is prevalent, rolling the land in the early spring months, soon in the morning, may have a tendency to crush and destroy them; and that where the fly is found to abound, and come out in the summer evenings on the grass lands or fallows, it is probable that, by rolling at that time the return of it into the earth, as well as the deposit of the ova, may be prevented, and the future propagation of the insect be guarded against. As the ova of this destructive animal is found to be chiefly deposited in the long grass on the sides of hedges and ditches, it has been proposed, as a sure mode of preventing the propagation of the grub, to keep the tops of ditches and hedge-sides perfectly clean and free from the coarse long herbage with which they are usually covered. And, on the same principle, the keeping of clover stubbles closely eaten down by sheep or other animals after the hay has been taken, till the wheat crop is nearly ready to be put in, has been found in some measure an effectual remedy against the destructive attacks of this insect.

Besides grubs, there are other insects which sometimes commit depredations on grain crops. One of these, which is believed to be the *Thrips Physapus* of Linnæus, is found to attack the late blossoming stems on their coming into flower, on which account early sowing may be the most effectual remedy.

But, in addition to the attacks of these animals, wheat crops are often exposed to injuries of other kinds, such as mildew, blight, blast, and smut.

The first of these vegetable diseases is frequently found to affect wheat and other crops, in their more advanced stages of growth, in such seasons as are wet and gloomy, for some length of time together,



without much sun. The nature of this *mucor mould*, or *mildew*, seems not yet to have been fully investigated by writers on husbandry; but, from the observations contained in an ingenious paper in the seventeenth volume of the *Annals of Agriculture*, there appear to be two varieties of it, the *black* and the *red*. Various conjectures have been entertained by writers concerning the cause of the disease; the most probable of which seems to be, that it is a plant of the *fungus* kind, which, like others of the same sort, is capable of proceeding in its growth in close shaded situations without much change of air, and which by its roots penetrates the vessels of the plants to which it attaches itself, but which were probably, however, previously in a morbid condition.

This is rendered still more probable as the cause of this mischievous disease from the observations which have lately been presented to the public by the Right Honourable Sir Joseph Banks in a valuable pamphlet, accompanied with magnified representations of the diseased states of the grain. And various interesting facts on the subject may likewise be seen in the forty-fourth volume of the *Annals of Agriculture*, as well as in the *Devonshire survey* lately published.

As moisture, and a confined state of air from shade or other similar causes have obviously much effect in producing the mildew in wheat and other grain crops, it seems not improbable that the best method of preventing or removing it would be that of not having the plants too much crowded together, but thin and open, so that light may be fully admitted, and a free circulation of air take place among the plants. This may be the most perfectly accomplished by the corn being sown in rows, with sufficient distances between them. Therefore on lands that are subject to mildew, the most advantageous method may be that of sowing the grain by means of the drill, and not too thickly in the rows. Where the disease is present, the most adviseable method, in order to its removal, may be that of thinning out the weakest plants as much as possible, that more air and light may be let in, and by that means the strength and vigour of the crop be increased and the disease eradicated.

The *blight* is an affection of the vegetable kind that not unfrequently attacks wheat crops in seasons that are more than ordinarily moist. It has been found, that in this disease, the green blades and stalks are beset with small spots of a black or rusty colour, before the ear becomes affected; and that after the grain has begun to shoot, and is fairly come into ear, many of the heads are often completely empty, but in some cases, only, empty in the upper half, the under remaining perfectly full. In others again, the ears are found to have alternately a plump well-filled *pickle* and an empty husk; and that in some, though not quite empty, they include only shrivelled imperfect grains, or what are termed *hungry pickles* by dealers. In different instances ears are observed, that are partly hungry and partly filled in a proper manner; and in a large proportion, there is an hungry and well-filled grain alternately; in short, that various ears, that appear well-filled, on opening the husks are discovered to be covered with spots of a black and rusty cast. A number of the stems



are in some instances met with that are perfectly withered their whole length. When ripened, the crop, in particular cases, is observed to have a dirty spotted appearance, as if sprinkled with soot, rather than the usual clean healthy yellow aspect; and the parts of the straw, or ears, that are not thus spotted, are neither white nor yellow, as is usual, but of a colour of the dusky or ash kind.

These appearances, which show themselves in the different stages of the blight, are supposed by the same author, to prove the existence of an insect as the cause of this vegetable disease; and that as the greatest injury is almost in every case done to such crops as have not been perfectly covered after sowing, or when the seed is very near the surface, while such as are deposited to a greater depth almost wholly escape, it is suggested, that, by depositing the grain more deeply in the soil, and covering it in a more perfect manner, as by drilling or dibbling, much may be effected in the prevention of this malady.

Others, however, consider the disease as a fungus of the linear, oblong, tawny, black kind, that attaches itself to the stems of the wheat plants at the period when the grain is nearly ripe, in such seasons as are very moist, affording a sooty appearance to the crop. It is asserted that the stems are apparently split, and the growth of the plants greatly impaired and restricted. The author of *Phytologia* supposes it to be a malady in some measure similar to the *rubigo* or *rust*, a disease that attacks particular plants that are previously in an unhealthy condition, and which may probably be prevented, or remedied, by the exposure of them to more light, and a greater degree of ventilation, as in the mildew or white *mucor*.

Whether the malady originate from insects, the action of other plants, a corrupted state of the vegetable fluids, or some peculiar defect in the vegetative process of the plants, it is probable the best mode of preventing or removing it will be the exposure of the plants as much as possible to the influence of the air, by sowing the grain with larger spaces, or thinning them out, when too thick and close, by the hoe in the later spring months, when the state of the crop is fully ascertained. That such methods may be beneficial, is clearly shown by the general observation, that hilly districts are much less exposed to the disease than such as are low, flat, and confined.

The *blast* is an affection of vegetables that proceeds from lightning, or the intense action of the sun, when the plants are in a state of considerable aptitude for the action of stimuli. It is the most common in hot climates: but Dr. Darwin, from having found that extensive wood-cutters often find trees cracked on being sawn through, suggests lightning as a more frequent cause of the disease in this country than is commonly supposed. The effects of these causes on wheat crops have been noticed by Tull, and described as occurring in blackish patches in different parts of the fields. As the vital power of the plants is mostly, in these cases, either completely exhausted by the great and sudden operation of such stimuli, or their vascular system destroyed by their expansive action, no remedy can be of any great utility.



The *ustilago*, or *smut*, is another vegetable disease to which wheat and other grain crops are often exposed, and in which a sort of black meal is produced in the place of seed. It has been ascribed to many different causes by writers on agriculture. It is remarked in the Memoirs of the Bath Agricultural Society, that this is a disease that only occurs when the weather is wet during the period of flowering, in which the *anthers* may burst, and the *farina* be washed away. The disease is there supposed not to be produced by any infectious substance, or the ova of insects that may adhere to the grain, as smutty ears and sound ones were found proceeding from the same root, and, in some instances, both smutty and sound grains to be contained in the same ear; some of the corns having even one end smutty and the other sound. It is therefore supposed to arise in consequence of the want of due impregnation, from the *farina fecundans* being faulty, and that putrefaction takes place on the death of the corn. This opinion is supported by the experiments of Spallanzani, who discovered that the seed is produced in the plants long anterior to impregnation, which cannot be performed until the flower is open, and the dust of the anther fully ripe.

On these grounds, it is conceived that, for want of impregnation, or the vivifying principle, the wheat corn may putrify, as is the case with the addle eggs of oviparous animals. The enquiries of a writer who seems to have paid much attention to the subject, are, however, highly in favour of the opinion, that the malady is produced by the attacks of an insect; and that, though unquestionably infectious, it may be prevented, or cured, by the use of different kinds of steeps, such as have been already described.

But though these methods may be employed in order to prevent the propagation of the disease, it is probable that it can only be effectually guarded against by sowing the seed in such a manner as to admit of a perfectly free circulation of air among the plants, and of those modes of after-culture that are adapted to promote their healthy and vigorous growth.

It has been suggested that grain discoloured with the smut may be readily rendered proper for sale by washing and drying it upon a malt kiln, as the sound corn is some time in saturating itself with moisture. Sand may also be used for the same purpose, which, after being mixed and well agitated with the grain, may be separated by means of a sieve. And a machine for cleaning smutty wheat is represented and described in the Berkshire Agricultural Survey lately published.

There are particular states of the weather that have considerable influence on the wheat crops at particular periods of their growth. When the season is sufficiently dry, there is seldom much injury done to them during the winter months, however severe they may be in other respects; nor in those of the summer, provided the weather is not too moist about the blooming season, as where that is the case the crops are mostly deficient.

There are several different sorts of weeds that become injurious to wheat crops, where they have been put in upon lands in an imper-



fect state of preparation. On the lighter kinds of soils, especially those of the calcareous description, *charlock* \* is often extremely troublesome. It is a weed that bears a yellow flower in some of the kinds, and a white one in the other, and is not therefore one individual plant, as generally supposed by the most part of farmers, but three distinct species each of which is prevalent in different places. These are the rough-leaved charlock, or wild mustard; the smooth-leaved, or wild rape; and the rough-leaved wild radish having white flowers †. They are all annual plants, arising from seed which they afford in great abundance, and which, if suffered to be shed on the land, remain for a great number of years enveloped in the clods, in a condition fit for vegetation on exposure to the influence of air and a suitable degree of moisture, by means of ploughing, or any other method of breaking up and reducing the soil. Such plants should, of course, never be permitted to run to seed, but be extirpated in their young state, either by hoeing or some other means: as, by attention in this way, much inconvenience may be avoided, as the increase by seeding is hardly to be conceived. Bindweed is also a weed of the parasitical sort, that is highly injurious to wheat crops on this sort of land. It is of two kinds, the common and the black ‡, and may be removed with greater ease than the above, by affording sufficient tillage. The *corn poppy* § is another weed, that is often injurious to these crops on the chalky sorts of land. It mostly makes its appearance about May, proceeding with such rapidity in its growth, both in height and laterally, as soon to over-top the grain, and destroy the crop, by the shade that it produces, the corn being rendered thin and defective in the ear. In these cases it is the custom of some districts to obviate the mischief by eating the weeds in the early spring, as about May, by hogs, which are said to be so particularly fond of the plant as to devour it with avidity, and in preference to the young wheat. The practice seems, however, dangerous, and a better and more safe remedy is at hand in due tillage of the land, and the early extirpation of the plants by the hoe.

*Cockle* ¶ is likewise a weed that often proves hurtful to crops of wheat. It is of great increase, frequently sending off several stems from the same root, each containing many pods filled with seed. It usually blows about June, with a pink-coloured blossom, and may then be eradicated without much difficulty, by pulling up the plants as they come up. There are two sorts of this weed, the common and ear cockle. The latter, according to a late practical writer, varies from the former, in being considerably smaller in size, and by its peculiarity of growing within the ear of the wheat plant; in

\* It is often, besides this, known by the different names of *cadlock*, *ketlock*, *kilk*, in particular districts.

† The *sinapis nigra*, the *brassica napus*, and the *rephanus raphanistrum*, of botanists.

‡ The *convolvulus arvensis* and the *poligonum convolvulus*, of botanists.

§ The *papaver rhoeas* of the botanical writers.

¶ The *agrostemma githago* of writers on botany.



some instances the whole ear affording no other produce than this, while, in others, one part of it contains perfectly formed wheat, and the other ear-cockle.

*White darnel*\* is another very prolific weed that does much injury to wheat crops, both during the time of its growth, and when at market, by spoiling the sample. It is an annual plant, the stem of which has a slight resemblance to that of the grain, and may probably be best prevented by attention to the putting in such seed wheat as is perfectly clean. Where it occurs, the safest method is to draw it out by the hand.

*Puck-needle*† is a weed that is often abundant on such lands as are hard tilled, and almost equally injurious with the above in lessening the value of the sample at the market. As the seed of this wheat is not easily separated in cleaning the corn, much care is always necessary in order to prevent its being sown with the seed.

*Couch*, or what in many districts is better known by the name of squitch, is a weed that is highly injurious to wheat crops, and extremely difficult and expensive in its removal to the cultivators of such arable lands as those described above. It does not comprehend the roots of any one particular, but of several sorts of perennial grasses, especially those of the bent kind, the dog's grass, the creeping soft grass, the tall oat grass, &c. ‡. The roots of these different grasses are not unfrequently in such lands as have been exhausted and worn out by improper tillage, so interwoven with the soil, and in so matted a condition, as to obstruct the progress of the plough. They are found to be most abundant in the lighter and more mixed kinds of soil. Weeds of these kinds are only capable of being completely removed and destroyed by having them drawn out, while the land is under fallow, by means of heavy harrows constructed for the purpose, with a greater number of teeth, or tines, than is necessary for those of the common sort, and placed so as to incline more forward. When brought into heaps in this way, they may either be consumed by fire, or reduced into a compost, by the incorporating of lime, in its unslaked or most caustic state, with them, and afterwards adding dung, or rich mould, in a suitable proportion. The latter is by much the most economical method when lime can be readily procured, and is not attended with much trouble, as such composts may be formed in the corners or other parts of the fields where the weeds are produced. The usual method of picking out the roots by hand labour, which is termed *couching*, is not only tedious and expensive, but seldom effectually performed. The well-known property of these roots to propagate and encourage different sorts of grubs, worms, or other insects, affords a strong inducement to effect the destruction of such root weeds by every possible means, especially where wheat crops are to be grown.

\* This is the *lolium temulentum* of botanists, and is often known to farmers by the names of *drake* or *droke*.

† The *scardix pecten veneris* of botanists, and what is often known to agricultors by the names of Shepherd's needle, Beggar's needle, &c.

‡ The *agrostis*, the *tritium repens*, the *holcus mollis*, and the *avena elatior* of botanical authors.



Besides these weeds, there are others that are equally hurtful to wheat crops in lands that have not undergone a proper preparation by tillage and are rather strong and moist, such as the corn crow-foot, the tare, &c.\*. In grounds where the latter predominates, care should constantly be taken to destroy it, by reducing them into a state of fine tilth before the wheat is put in.

*Coltsfoot* † is a weed that, in soils of the moist and rather heavy kinds that have been considerably exhausted by tillage, is liable to become troublesome, and of great disadvantage to the wheat crops. As this weed begins to shew its flower towards February and March, and soon afterwards ripens its seeds, it should not by any means be neglected at such periods, as from the levity of them, and their downy nature, they are quickly conveyed to a distance, by which means they soon establish themselves in different places. Repeated ploughings during the summer season, by rendering the soil light and mellow, may render them capable of being more readily extirpated by weeding. And as they delight in moisture, laying the soil more dry by the forming of proper drains may also be of great utility. But from the roots of the plants spreading themselves extensively near the surface of the land, they will constantly require to be completely extirpated.

Wheat is known to be ripe and ready for the reaper, by its straw turning of a yellow colour, its ears beginning to bend in the neck and hang down, their having no greenness in the middle of them, and the grain becoming hard and plump‡. The quantity of wheat produced upon the acre must vary considerably according to the circumstances of soil and preparation, as well as the state of the season; for it has been found, that some years the yield is under twenty while in others it is upwards of thirty bushels the acre, the soil and culture being in every respect the same. The average return of this crop throughout the whole of the kingdom, is probably not more than from three to three and a half quarters. A practical writer has, indeed, stated it at not more than three.

In Middlesex, the greatest crop of wheat of which the author of the Report of that district has any account, is, he says, sixty-eight bushels per acre; the least about twelve. The medium between these extremes is forty, which, he thinks, would be the average of land highly conditioned. But the average produce of Britain does not, he supposes, exceed one half of this quantity, and yet, says he, wheat is as certain a crop as any that is cultivated. This, he thinks, affords a clear proof that “the lands of England are reduced considerably below par, which,” in his opinion, “can only have happened by a too frequent repetition of corn crops, and general bad management, which has of course lessened the *quantity* of *live stock*, and with that, the best means of raising *manure*. Let farmers, be induced to sow crops to be eaten on the land by cattle, so that they may there leave their dung and urine, and corn will then be grown

\* The *ranunculus arvensis* and *croum tetraspermum* of botanists.

† The *tussilago farfara* of writers on botany.

‡ See Section IV. On the Management of Grain and other Crops.



in double quantity ; and the live stock, supported by such green crops, be clear gain to the community.”

In order to ascertain the goodness of a sample of wheat, it is necessary to judge by the eye whether the *berry* be perfectly fed, or full, plump, and bright, and whether there be any adulteration proceeding from sprouted grains, smut, or the seeds of weeds ; and by the smell, whether there be any improper impregnation, and whether it has been too much heated in the mow or upon the kiln ; and finally, by the feel, to determine if the grain be sufficiently dry, as when much loaded with moisture it is improper for the uses of the miller. Where the sample handles coarse, rough, and does not slip easily in the hand, it may be decided not to be in a condition either for grinding or laying up in the granary. The same means may also serve to determine the weight ; but considerable experience is necessary to decide with much correctness. It is observed by the author of the Synopsis of Husbandry, that it “ is a good sample of wheat where the weight of a sack, at eight gallons the bushel in measure, arrives at four bushels three and a quarter pecks in weight, or 2 cwt. 1 qr. 18lb.

*Rye.*—This is a species of grain which probably approaches nearest to the nature of wheat of any that is at present in cultivation. It has two varieties, the *winter* and *spring* rye, or what is often farther distinguished into the *black* and *white* or Dantzick rye. The former sort is the largest, and the most plump and hardy, consequently the most frequently grown by farmers ; but the spring kind may often be employed with success. The grain is so capable of resisting the effects of the weather, that, when sown in the autumn, it is seldom much injured by the most severe winter. It is more early in the spring than wheat, and, though not equally valuable, is more certain of producing a good crop.

This sort of grain is capable of being cultivated on most kinds of land ; but the light dry sandy soils, that cannot be converted to the purpose of wheat or barley crops, are perhaps the only ones on which it can be grown to advantage, from their being the most adapted to it, and from few of them being so light or poor as not to afford good crops. It can, of course, only be introduced with success on such lands as are incapable of producing other sorts of corn to advantage, and where the improved methods of cultivating wheat crops have not been had recourse to. Even upon some of the poorest sorts of sandy soil, wheat is supposed in some districts to be grown with more benefit to the cultivator, the quality of the land being the same, than this grain. And from fowls being less fond of it than most other sorts of grain, it may be the most proper to be cultivated on those portions of grounds that are situated close around the farm houses.

It is a kind of crop that is mostly grown after early-fed turnips, clover, peas, and other similar products, as well as after naked fallows, in particular cases. When cultivated on the cold and heavy kinds of soil, the grain is much later in becoming ripe than on such as are dry and light.

This crop, like that of wheat, requires the land to be in a toler-



able state of pulverisation, and perfectly cleared from weeds. In many districts, when intended to stand for a crop, it is the custom to put it in upon some sort of fallow: but where it is only to be fed off by sheep, seldom more than one ploughing is given, the land being broken up and fallowed for turnips immediately after the crop has been sufficiently eaten down by sheep or other animals. It is the practice in some places to apply manure immediately for this crop; but where the soil is in a suitable state of preparation, and has not previously been too much deteriorated by the growth of other grain crops, it may be more advisable, especially where it is not to be fed off, to defer the application of the manure, in order that it may be employed for the turnip or other green crop that may succeed it, the use of manure being apt to bring up weeds.

*Time of sowing.*—The periods of putting this kind of crop into the soil are, in general, pretty much the same as those of wheat; but when cultivated for green food, it may be advantageous to sow early, as in August and September; but it may be sown in October, and during the winter months, until the beginning of March, in particular cases, as where the early sowings have failed, or there is an intention of having a succession of this sort of feed for sheep.

*Seed.*—The general allowance of seed, where the crop is designed to remain for grain, is in most situations from about two bushels to two and a half; but when the intention is to feed it off, three, or even more, may be a better proportion, as the plants in such cases should stand considerably thicker upon the ground, in order that the largest possible quantity of green food may be provided. As the process of germination in this sort of grain is rather slow, it may be advisable to put it into the ground when it is in a tolerably dry condition, otherwise much of it may perish, especially in wet seasons.

It was formerly a prevailing custom to blend several other sorts of seed with that of rye, and the practice still continues in some districts in respect to wheat and winter tares; but it is by no means either judicious or useful, since, in the first case, the rye is in a state fit for reaping long before the wheat, consequently much loss must be sustained: and, in the latter, it is mostly in a condition to be cut as green food some weeks before the tares, and becomes ripe at much too early a period for them.

Where wheat is combined with rye, it is in many districts termed *meslin*, the proportion of the latter to that of the former being regulated by the nature of the soil, and the judgment of the cultivator, the principle being that of giving the largest proportion of rye to the lightest kinds of soil.

*After-culture.*—When this sort of crop is grown for the purpose of the grain, it will be constantly necessary to keep it clean in the early stages of its growth by hand weeding and hoeing, when they may appear requisite; but where the intention is merely that of affording a supply of green food for the use of sheep or other animals in the more early spring months, no further culture will be wanted after the crop has been put into the ground. This sort of crop is known to be ready for the sickle by the straw of the stems



becoming of a yellowish colour, the ears hanging down, and the grain feeling hard, and in a plump and full condition.

In the poor sandy soils of Suffolk, good crops of this sort are seldom afforded, and on those of a better quality the produce is rarely more than from two to three quarters on the acre. But in the north riding of Yorkshire, it is stated to amount to from three to six quarters.

When this sort of grain is free from weeds, and cut when the weather is fine, it may be secured in the stack as fast as the reaping proceeds. And the straw of this grain is superior to that of wheat, both for the purpose of thatch, and for the use of the collar-makers.

This is a kind of grain that is also cultivated in particular cases, as where the ground is sufficiently light and dry, to be turned down as a manure\*.

It is sometimes the practice of farmers, when rye is intended to stand for a crop, to feed it with sheep in the early spring, as in the beginning of March; but this should never be done except where the crop is very luxuriant, and at so early a period as that there may not be any danger of destroying the new-formed ear.

In the southern part of the kingdom it is also often cultivated for the uses of those engaged in the business of tanning leather; but more frequently as a green food for sheep in the spring, before the turnip crops are ready. When grown in this view, it is necessary to have attention to different circumstances, in order to derive the utmost advantage from the crops. As this grain begins to shoot out, or spindle, as it is termed by farmers, much earlier than wheat, care, as has been just observed, should be taken that the feeding of it down is begun at a sufficiently early period before the ear is formed in the *hose*, as the latter end of February or beginning of March; otherwise the stem or blade becomes firm and sticky, and the succession of green feed, after the first eating, extremely small. Indeed this may be done earlier than the first of these periods, in cases where the season is mild and open, and persevered in till the end of April.

In feeding this sort of crop off by sheep, it will likewise constantly be necessary to keep the fields properly divided by means of hurdles, as in this way the loss of food will be much less, and some parts will become fresh while the others are eating down.

*Buck-wheat.*—This is a sort of crop that may frequently be cultivated with advantage in different points of view. Its utility has been much extolled by some cultivators, while others have thought less favourably of its benefits: with good farmers it may however be a valuable crop.

It is capable of being grown on most sorts of soil, provided they be sufficiently dry, and in a tolerably fertile state; but answers best on those of the thinner kinds, especially where they are of a sandy nature. Mr. Young remarks that “nineteen parishes out of twenty through the kingdom know it only by name. It has numerous ex-

\* Section on Manures.



cellencies, perhaps as many to good farmers as any other grain or pulse in use. It is of an enriching nature, having the quality of preparing for wheat or any other crop." It is added that "it is as valuable as barley, and where known it sells at the same price. It also equals it for fattening hogs and poultry." And further, that "for sowing grass seeds with, it is the best of all crops, as it gives them the same shelter as barley or oats, without robbing or exhausting the land."

In the preparation of the land it is less difficult than many other plants, being sometimes sown with success upon one earth. It is best to plough and harrow the land well in April for the reception of the crop in the following month or later; a fine clean state of tilth being the best, as grass-seeds are mostly sown with it.

*Seed and Time of Sowing.*—The proportion of seed that is necessary in raising a crop of this sort is about a bushel to the acre; and it may be sown at different times, in the spring and summer season, as in May, and about the end of June, or beginning of the following month. As it is a tender plant in its early growth, it should never be sown too early, so as to be in danger from frosts. It is generally sown in the broadcast method, being well harrowed in.

*After-management.*—As crops of buck-wheat usually cover the ground well, there is seldom much attention necessary in their culture afterwards.

In the application of the crop, it is either suffered to remain for the purpose of seed, cut and used green for cattle, or ploughed under as a manure. In the first method, the produce is from four or five to seven or eight sacks, which is made use of in feeding horses, fattening hogs, and keeping poultry. If ground, it affords a white flour. In soiling cattle, it may be mown twice in the summer season. When given to milch cows, it is said to increase the flow of milk in a considerable degree. In feeding it down green by hogs, it has been found to produce an inebriating effect upon them. The quantity of food that it affords in this mode of consumption does not seem to be well ascertained.

When cultivated after tares, in Mr. Moseley's trials it was found to be highly advantageous as a preparation for wheat, preserving the land, after their removal, from the effects of the sun till the period of the wheat being put in. In Mr. Young's opinion much is effected by this combination of crops: "a coat of manure is gained at no expense, the year carried through from Michaelmas to Michaelmas; and three crops put in, on three ploughings, viz. tares, buck-wheat, and wheat." It is not, he supposes, easy to form a more complete system.

In particular situations and circumstances, as where barley or other spring corn cannot be put in sufficiently early, the culture of this plant may be practised with great advantage.

In harvesting it is very liable to shed, of course when ripe it is best to cut it while the dew is upon it, and leave it to dry in the field. In some cases it should likewise be carted in the dew for the same reason. It is mostly ripe about the latter end of September.



*Barley*.—This is a much less hardy sort of grain than either of those that have been described; but from its great utility in the composition of malt liquors, and in the preparation of various kinds of spirit, it is extensively cultivated in such districts as, from the nature of their soils, are adapted to its growth. It may, indeed, be considered as the next grain in value to that of wheat.

There are several kinds of this grain cultivated in particular parts of the kingdom, as the *spring* or common *barley*, the *long-eared barley*, the *sprat* or *battledore barley*, the *bear* or *square barley*, and the *big barley*. The first species of barley is grown pretty extensively in the southern as well as the eastern parts of the island; and the second, or long eared sort, may frequently be met with, but from the great length and weight of its ears, it is more apt to lodge, consequently is more hazardous than that of the common or spring kind. The sprat or battledore sort is broader in the ear than any of the others, and has at the same time a shorter and more tapering stem, with erect ears, on which accounts it is less disposed to lodge or fall to the ground. It is often distinguished by the title of Fulham barley, from its having been extensively cultivated in the neighbourhood of that place. The *bear* or four-rowed barley, and the *big* or six-rowed barley, are grown to considerable extent in the north-western parts of England, as well as in Scotland. These are winter barleys, and require to be put into the ground in the autumnal season, somewhat in the manner of wheat.

From the tender and delicate nature of this sort of grain, especially in the more early stages of its growth, it is incapable of being cultivated with advantage on the stiff, heavy, and wet descriptions of soil, or such as are of a cold and tenacious quality. It is said to grow in the most perfect manner in a loamy sand, or such soils as are moderately dry, and sufficiently light. The most plump and thinnest-rined grain is asserted to be produced on such lands as are dry, light and mellow; and these are the qualities that are considered as the most estimable. Light poor land, when dry and warm in respect to soil and situation, is even capable of affording barley that is much superior in quality to such as is grown on strong lands that are of a cold and moist nature.

This sort of grain is cultivated after almost every kind of crop; but it has been found to succeed to the most advantage after those of the green or ameliorating kind; as turnips, potatoes, carrots, peas, tares, &c. However, from the nature of grain crops, it can seldom be cultivated to great advantage after wheat, rye, or oats: in such cases it has generally been observed that the crops were blighted and imperfectly fed, even upon soils the most adapted to this sort of grain. Where flax, hemp, or rape, are grown, barley may sometimes be sown after them. When sown after any of these improving crops, manure is seldom necessary; as in many of them the soil must be rendered suitable by the feeding of them off by animals, and in the others, from a large proportion of it being prepared for the growth of such crops, it must be equally unnecessary. If, however, a wheat or other sort of stubble be chosen for the purpose, manure will be requisite, which should always be well



mixed and incorporated with the mould before the seed is put in, and be in a considerable state of reduction before it is applied.

After whatever sort of crop this grain may be grown, as the root is extremely tender, and requires much support during the first stages of the growth of the plant, from the quick manner in which the process of vegetation is carried on, the soil should constantly be reduced into a state of much fineness and pulverisation, so as to become properly open and porous, in order to secure a more certain, equal, and perfect vegetation. This is to be effected by different slight or ebb ploughings and harrowings, as well as by occasional cross-ploughing and rolling. The improved system of management in preparing all the heavier sorts of land for the reception of this and many other spring crops, is that of ploughing the lands in autumn on to such forms of ridges as may be suitable for the particular method of sowing that may be practised, and to render the surface fine for the seed by scarifying and scuffling at the season of putting it into the ground.

It has been observed that in putting this crop in after turnips, it has been long the practice in Suffolk to do it by means of drilling without any ploughing. For this purpose, as well as for many others, the surface of the land is, he says, thrown on to lands of such breadths as suit in an exact manner for one stroke or going of the drill machine, or for two, which is termed a *bout*. The shafts of the drill are fixed like those of a cart for one horse that quarters; the horse-hoeing implements, scarifiers, and scufflers that may be employed, being prepared according to the drill machine, so as to fit the lands or ridges exactly. Supposing the turnips to have been drilled or sown on lands sixty-six inches in width, which admits seven rows of barley to be drilled at nine inches apart leaving twelve inches for each furrow. These lands being cleared of the roots by eating them with sheep, or by carting them off with carts so contrived as that the horses and wheels may pass along only in the furrows, the surface soil being in some measure mellowed and rendered fine by the frosts, the question is how to prepare it for barley or oats. “The husbandry universal till very lately was, Mr. Young says, that of ploughing such land once, twice, or thrice for spring corn; the better farmers thrice, others once, and a few twice. Upon very dry soils, the evil was little more than that of a useless expense, except probably a greater dissipation of the volatile particles of the urine of the sheep that had fed on the turnips: but upon all other soils more stiff and unmanageable, the surface which had been rendered friable by the frosts, being turned down, and the more stiff and *clung* bottom not influenced in the same manner by those natural agents being brought up, it might also, if very favourable weather ensued, be brought into good order; but if the season proved the least unfavourable, the farmer could have no chance of obtaining so fine and safe a tilth as the surface was capable of, without any such reversal of it by ploughing: the new system is, he says, to apply the scarifiers instead of such ploughing. Mr. Cook’s, with his cast-iron beam, or any other heavy enough, is used, the horses walking only in the furrows, and consequently without any



trampling of the land. These scarifiers are of different breadths, but all narrow, usually about three inches, or at most four, and they will go as deeply as may be thought proper. They ought, he thinks, to stir to the depth to which it would have been ploughed, whether four, five, or six inches. They completely loosen the soil, let down the air, to dry it at bottom, give a very good tilth with the material advantage of not burying that pulverised surface which frosts have given, and which, if once lost, may not be regained in time for barley. In some cases, one scarifying and two or three harrowings will effect the preparation; in others two. Three operations may be wanted in others, that is, two scarifyings and one scuffling, with broader triangular shares. These variations will depend entirely on the degree in which the soil is tenacious, and to ascertain which the farmer's eye and foot can alone enable him to judge. These operations go off very quickly, and leave the land or stitches in excellent order for the drill-machine to follow, and deposit the barley seed; the farmer, during the whole of these operations, being as little liable to be thrown out by unfavourable weather, as it is possible he should be, and much less so than if he had ploughed the land. Those, says Mr. Young, who are used to attend to the effects of tillage on different soils, know well that loams and clays of various degrees of tenacity, if they have been properly formed into lands for winter, and not poached by horses trampling, receive the frosts to advantage, and are found with a friable surface in the spring. If rain comes, it dries and leaves the surface still in good order, and ready for any operation; but plough such land, and turn up the more adhesive bottom, not acted upon by frost, and let rain fall on such fresh turned furrows; it remains stiff and saddened; it does not become porous again; the air cannot get into it: and if drying sharp winds at north-east follow, the furrows become longitudinal slices of clod, very difficult to be acted upon by any instrument, and the farmer finds himself in a most unpleasant situation. He no more recovers a fine friable surface, and it becomes twenty to one whether he has a good crop. His only chance, is to have abundance of patience, to wait for favourable weather, and lay his account to sow very late." The reason for this advice of avoiding spring-ploughings is, the same writer says, "not drawn from the practise of a few farmers, but from those of an extensive well cultivated district." And "these directions are not confined to the drill husbandry, but are applicable to the preparation of the land for broad-casting;" but in this last method, similar attention must be given to the breadth of the lands, as the operations must be effected by horses walking only in the furrows: and when the seed is covered by harrowing, the same regard must be paid to that circumstance.

When this sort of crop is introduced upon green fallows, such as turnips, &c. it is sometimes the custom to prepare the land only by one ploughing; but a better practise is that of giving two earths, the first as early in the spring as it can be done, and the second immediately before the seed is put in. This is the practice mostly adopted in Norfolk, where the barley husbandry, on turnip fallows, is, in most instances, well performed. Ploughing but once for



summer corn has however been advised by some: this practise, it has been observed by an intelligent farmer, though certainly not general in the county of Norfolk, is yet by no means uncommon. His crop of barley was never more abundant than it was last year from a single ploughing. He has now between forty and fifty acres, which have the appearance of being very productive at the ensuing harvest, not one acre of which has been ploughed twice. This practice certainly saves expense, saves time, and is very simple. He does not, however, mean to recommend it merely because he adopts it himself; every man must be guided by circumstances: if his land is foul he must clean it, and frequent ploughing is at once the cheapest and most effectual method he can pursue. Without venturing to recommend the practice, a Norfolk farmer states a fact: In the year 1800, he sowed between forty and fifty acres of barley upon turnip land ploughed only once, and thrashed somewhat more than eleven coombs:—three bushels per acre. This was in the year of scarcity. In 1801, he grew only twenty-four acres of barley; about half of which was drilled, the land having been previously pulverized by repeated ploughings, the other half *once* ploughed only after the turnips were off. The result was much in favour of the broadcast barley: but it should be observed that the drill did not deliver the seed with sufficient regularity:—he grew eight coombs:—two bushels round. The year following he sowed forty-two acres of barley broadcast: wanting to bring his land upon smaller ridges, he *worked it about*: the crop of barley was very great. He has already thrashed about ten coombs per acre, and calculates that he has between two and three coombs per acre yet in the straw. By his advice, his tenant has this year sown almost his whole barley crop with a single ploughing, his turnip-land being clean, with the exception of one piece, which he was advised to plough several times. The weather having continued remarkably dry, was the reason of the recommendation. By ploughing land two or three times and harrowing it as often in dry weather, whatever moisture there is must evaporate. Corn deposited in land in this situation comes up at two different times; the superficial corn, that which being lightly buried feels the influence of dews, and sprouts up; that which lies deeper will not germinate till a shower of rain comes. At harvest time one half of the farmer's crop would be shelled before the other would be ripe. The year before, the seed-time was *dropping* as the farmers call it, or he should not have worked his land so much about."

In sowing this grain after peas, or other pulse crops, it is customary in most districts to give the first earth or ploughing in the autumn, which should always be performed in such a manner, as that the greatest possible extent of surface may be exposed to the influence of the atmosphere and the action of the frosts; the ridges being at the same time so laid up, as that no injury may be produced by the wetness that may take place during the winter season. The second earth or furrow\* is mostly given about March, when the oat crop has been put into the soil. By this ploughing, two different

\* This is sometimes termed the *steering* furrow in the northern districts.



purposes are effected in many cases; the root-weeds, such as those of couch, and other noxious plants, may be loosened, so as to be more readily extirpated by the application of the harrows immediately afterwards, and the soil reduced to so fine a tilth, as that those of the seed kind may be induced to vegetate freely, and in consequence be more perfectly removed by the action of the plough and harrow at the period of putting in the seed.

If this kind of grain be introduced after wheat, or other sorts of corn crops, which, as has been shewn, is by no means a practice to be recommended, the preparation of the land is mostly conducted in the same manner as the above.

*Time of sowing.*—The period of putting this sort of crop into the soil must, of course, vary in some degree according to the nature and quality of the land, and its situation in respect to climate. In most of the more southern districts of the kingdom it generally commences about the latter end of February, or the beginning of March; but in the northern parts of the island it often begins a month or six weeks later. The largest quantity of seed is usually sown from the middle of March to the latter end of April. The earlier it can be put into the soil in a proper state the better the crop will be in general; but much must always depend on the circumstances of the season and the condition of the land.

*Seed.*—The proportion of seed that may be necessary must be different, as the soil is of a richer or poorer quality, as the season of putting it into the earth is more early or late; and according to the manner in which it is put into the ground. The nature of the crop after which it is cultivated may also render some difference in the proportion of the seed requisite. Much less seed is demanded where the soil is rich and fertile, than where it is poor and exhausted; and the drill method of sowing less than where the broadcast plan is pursued.—Early sowing also requires less seed than where a late period is adopted. It has been observed, that on a medium soil, in proper condition, sown broadcast, the proper proportion may be in March three and a half, in April four, and in May four and a half, bushels to the acre. Such is the difference of rich soils, that it is supposed that it can hardly be sown too thin: one bushel and a half sown early having afforded as much as could stand: where, if three or four had been put in, the grain would have been lodged, and of course greatly reduced in its value.—After turnips, and other green crops, a much less quantity is generally necessary, as such lands are mostly in a perfectly suitable state for the reception of barley crops.

The seed is put into the soil in different methods, being in some cases sown under the furrow, and in others above it. Where the first practice is adopted, the seed furrow should be very light, otherwise the grain may be deposited to such a depth as to greatly retard, or even prevent, much of the seed from coming up in proper time. When sown on the surface, great care should be taken that the seed be well harrowed into the soil, and so covered, as that the grain may vegetate, and grow up in as equal and regular a manner as possible.



It is the practice of many districts to sow clover, and other grass seeds, with this crop; but where the soils are very rich, and of a good quality, this method of husbandry is improper, as much inconvenience and injury may be done to the grain by the rapid and over-luxuriant growth of such crops, rendering the plants weak and imperfectly fed. On the thinner and less fertile soils where the growth of such grasses is less vigorous, it may however be adopted with advantage in many cases, as little injury will be done to the grain, while the straw may be considerably improved in the way of fodder. Where this mode of management is had recourse to, the sowing of the grass seeds may be deferred for some time after the grain has been sown; and when they are put in, a light harrow may be passed over them, and the land be afterwards well rolled.

The success that has attended the use of the drill and the setting of grain in particular cases, suggests the propriety of attempting similar practices in the cultivation of this sort of crop, especially on the richer descriptions of barley soils, as by such methods it seems probable that the quality as well as the produce may be greatly improved where this system is pursued the most.

Though the practice of steeping this kind of grain before it is put into the ground is not in general use with farmers, it is probable, as has been just observed, that much advantage might be derived from it, especially as the season is commonly hot and dry when it is performed, from the more quick and uniform vegetation of the crop. It is likewise supposed by some agriculturists, that by mixing soot with such steeps the danger from insects may be diminished.

In the choice of seed, attention should constantly be paid to the colour and the state of the skin or rind of the grain; as that is esteemed the best which has a pale lively bright appearance, without having the tails of the corn stained in any way, and which is full and plump, or what is often termed well-bodied. It is common with practical farmers to change the seed of barley every year or two, from the supposition that the grain becomes coarser by the repeated sowing of the same kind of seed. The necessity of this custom may, however, probably arise from the neglect of making use of such seed as is full-bodied and perfectly fed and ripened.

*After-culture.*—As this sort of crop is mostly sown broadcast, it seldom receives any improvement by culture afterwards. It is obvious, however, that by occasionally stirring and loosening the mould about the roots of the plants, and keeping them clean and perfectly free from weeds, much advantage might be obtained in many cases in the cultivation of this sort of grain; as it may thereby be rendered not only more abundant upon the ground, but the sample be considerably improved. The drill sown crops have obviously an advantage in this respect, as has been noticed above, and which should of course recommend the practice.

When the season turns out dry and unkindly in the early spring months, this sort of crop is often much injured by the attacks of the worm; which is obvious from the sudden change in the appearance of the plants, from a healthy green to a yellow cast. On the first appearance of this change, the use of the roller should be had



recourse to, in order that the superficial parts of the soil, which are probably become too loose and porous, may be effectually pressed, and thereby rendered too close and compact to admit the worm to prey upon the tender roots of the young plants. That this effect may be produced in the most effectual manner, the roller should be of such a size, or so loaded, as to afford a pressure equal to the draught of three or four horses, which should be yoked double, in order to increase the effect by their treading. It has been suggested, that, if by this method the injury can be counteracted until such time as rain falls, there need not be any apprehension of the crop, as the plants will soon push forward in such a manner as to become too strong to be in danger from this insect. It is probable too, that top-dressings, such as have been recommended for wheat, sown over the crop immediately before the use of the roller, might be of utility in lessening the ravages of this destructive worm. And it is found to be of the utmost consequence to the success of barley crops, that the weather prove moist about the period in which the plants shoot out in the ear; as where the contrary is the case, the crops are liable to sustain much injury, from the want of that supply of food which is necessary for the perfect formation of the grain.

The produce of this kind of grain, like that of most others, varies considerably according to the state of the soil, climate, and the cultivation that is employed; but the average over the whole kingdom is probably from about twenty-seven to thirty bushels the acre. In the county of Middlesex, according to the report of that district, the average produce is about four quarters of grain and two loads of straw to the acre; and in Yorkshire, on the turnip lands, the produce is nearly the same; but in many other districts, it does not average more than three and a half. It is stated that, in Middlesex, the straw generally fetches about one guinea a load when delivered in, which, together with the chaff and thin grain, is equal to one shilling and sixpence the bushel on the corn, and that, as the corn averages three shillings, they produce together four shillings and six pence the bushel, or seven pounds four shillings the acre.

This sort of grain is shown to be ripe by the disappearance of the reddish cast on the ear, or what by farmers is termed *red roan*, by the ears beginning to droop and bend themselves round against the stems, and by the stalks becoming brittle and of a yellowish colour.

Barley should constantly remain out in the field until it be perfectly dry and free from moisture, otherwise it is liable to heat in the stack, and the sample be thereby greatly injured both for the purposes of seed and malting. It is found by experience that the Fulham barley, which has been once sown on stiff loamy soils, is the most suitable for the purposes of malting, as the skin is thinner, and the quantity of meal considerably larger. From its quicker growth it is of course less exposed in the field to the effects of moisture, which is known to be highly injurious to this grain, and on which the good qualities just mentioned may in a great measure depend. It is the fine white clear thin-skinned barleys that bring the highest prices at the markets, whether they be sold for the purposes of malting or those of seed.



*Oats*.—The cultivation of this sort of grain has of late years been considerably increased, probably on account of the greater demand for them in consequence of the great increase in the number of pleasure horses that have been kept.

It is a species of grain of which there are many varieties in cultivation; as the *white*, the *black*, the *red*, the *blue*, and the *naked* oat. There are likewise other varieties of this corn which are distinguished by the names of the countries from which they have been introduced; as the *Poland*, the *Tartarian* or *Siberian* and the *Friesland* oat. The first affords a plump and fine grain on soils of the dry warm kinds. The *white* oat is a valuable kind, and where the soil is dry, rich, and in a good state of cultivation, may be grown to great advantage, as it mostly brings the best price at the market, and yields the most abundantly in threshing out. It is cultivated the most extensively where the use of oat bread is general, as it affords the whitest meal.

The *black* oat may be grown where the land is inferior in quality: it is nearly equal in value, from its being found so highly nutritious as a food for cattle and horses. It stands a wet harvest well, and answers well on moist soils.

The *red* or *brown* oat is likewise proper for the stronger sorts of land; it is a very hardy kind, and affords a great increase. The grain is full and heavy, on which account it is probably to be preferred for the purpose of feeding animals to the above sorts.

The *blue* oat is only cultivated in particular districts. It is suggested in Miller's Dictionary as the sort known to farmers under the title of *Scotch Greys*.

The *naked* oat is a kind that is but little cultivated, except in particular places. It has, however, the property of threshing clean out of the husk. This sort has not, according to Ray, a hard husk as in the common oat, but several thin chaffy coats. The grain is also smaller, but fuller in the body, and inclining to a tawny colour. It may be cultivated on the poorer sorts of land.

The *Poland* oat has a short full-bodied grain; but it has yet been little introduced into cultivation, probably on account of the thickness of its skin or rind. The straw is short, the grain set single, and without awns.

The *Friesland* oat has a thin-skinned grain, and a large proportion of straw. The corns are for the most part double, the larger of which is in some cases awned, the awn being situated high. It is most suitable for the better sorts of land. It is known in some districts by the title of the *Dutch* oat.

In the *Siberian* or *Tartarian* oat the grains are thin and small, the largest of which are awned, but the small ones without awns. The straw is tall and reedy, on which account it is improper for the purpose of fodder for cattle. It may however be grown on the poorer sorts of soil.

The *Essex short Smalls*; so named from its remarkable shortness. It is very weighty, and succeeds well on all moderately dry lands.

*Churche's* oat is a white sort that affords well, and comes into ear the soonest of any.



The *Potatoe oat* has lately been much cultivated in the more northern parts of the island, and is said to be productive and afford much meal.

This sort of grain is hardy, and may be cultivated upon almost any kind of soil; but, as in others, it is the most productive on such as are strong, rich, and rather adhesive, and which have not been long broken up from the state of old grass. It is however probably better to cultivate peas or beans according to the nature of the land on newly broken up old lays than oats, except where the practice of paring and burning has been had recourse to. It is suggested that though this sort of grain generally sells lower than barley, yet from its being a more certain crop, the superior utility of the straw for the food of cattle, and the increase in the quantity of produce, it is equal to barley for medium loams. And that for stronger sorts of lands, and those of the fen kind, it is greatly superior to it, though apt to leave the land in a more foul and compact condition. On the cold, tenacious, fenny, and wet descriptions of soils, the oat may indeed in many cases be sown with more advantage than any other kinds of crop, and likewise where lands cannot be put in a proper condition for barley crops.

Oats succeed well after almost every sort of green and root crops, but should not be cultivated after wheat, rye, or barley, where it can possibly be avoided, as the soil by such cropping would be too greatly exhausted. It has been observed, that in districts where improved methods of husbandry are adopted, oats are generally grown upon such lands as have been newly broken up from the state of grass, and that the practice is shown to be perfectly correct, by the abundance of the produce in such cases. The custom of cultivating oat crops in succession for several years is equally absurd and improper, and should be generally exploded.

In regard to the preparation for this sort of crop, it is recommended by an intelligent cultivator that when it is intended to be grown after cole, tares, early peas, or such other crops as do not come off the ground later than the beginning of June, on soils that are too wet to admit of being ploughed in the winter season to make a clean bastard fallow, laying the land up into ridges proper for being sown in the early spring. Or when after such clean crops as come off too late to admit of the bastard fallowing, to plough only once, which should be as early as the business of the farm will admit, into ridges proper for the putting the seed in. In all cases it is a good practice to have the land in a fine state for the growth of this crop, which is best effected in the same way as for barley. And it is perfectly absurd to suppose that it will not be equally profitable to the farmer.

*Time of sowing.*—In this business it is necessary to keep in mind that the earlier the seed is put into the ground the sooner in general the crop will be ready to cut. In the more southern parts of the kingdom, it is often the case to put this sort of seed into the earth towards the latter end of February, when the season is dry and fine; but March is in general the oat seed season. And in some experiments this sort of crop has been found to succeed well when put in



early in January. On such soils as are naturally dry and parching it is by much the best practice to sow early, in order that the crop may be well established before the hot weather commences. And besides there may be a greater chance of the grain escaping the ravages of the worm that often attacks such crops; and when this insect is present its ravages may be more easily prevented. As this sort of crop is liable to be injured by very severe winters, it can seldom be safe to put it in in the autumn, especially in the northern parts of the island; but in the southern districts it may be done with propriety in particular cases, as where the land is of a very dry and friable nature, large crops having been asserted to have been grown in this way in combination with tares in some instances.

*Seed.*—The proportion of seed that may be required must differ according to the difference of the circumstances that have been already stated, but on soils of a middling quality, four bushels may be sufficient for the more early sowings, and five for the later ones, where they are put into the ground in the broadcast method. In some of the southern districts the *Poland* oat is sown at the rate of about four bushels the acre for the first sowings; and it has been found in practice that the earliest sown crops constantly afford the most perfect sample, and in general the most abundant produce. It is however often the case to sow larger proportions of this sort of grain.—In the practice of Mr. Walker, of Lincolnshire, advantage was found from sowing eight bushels to the acre, the crop being found better and the sample more equal than with a less quantity. “The oats are less *taily*, having no tillers to give different degrees of ripeness, and the crop being ready to cut four or five days sooner than with thinner sowing.” Mr. Duckett is said to hold the same opinion, and to drill five bushels per acre. With the oats, clover may be sown when necessary, the seeds being covered by harrowing suitably to the condition of the land, and where the soil is very light or mellow, a roller should be passed over it as soon after as possible, in order to press the mould to the seeds; but in other circumstances it may be more advisable to defer the rolling until the season is dry, and the crop somewhat advanced in its growth. The practice of sowing oats under furrow, though it has been attempted on the lighter and more dry sorts of land, is not by any means to be advised, as in such a method the seed is apt to be deposited to too great a depth, and to be in danger of either being in some measure destroyed, or of coming up in an irregular manner. The use of the drill has not been so much practised with this sort of crop as with many others, but its utility cannot be doubted in many cases; nor has that of dibbling been so fully employed as in other cases, but on old layers ploughed before the winter frosts commence, it has been had recourse to in the spring when the land was sufficiently dry, and in such a condition as to permit the holes to stand without being filled by the falling in of the mould.

As this kind of grain is supposed to be more liable than most others to degenerate, by being too long continued on the same land, it has been the practice of some districts to change it for such as has been imported from other countries. It is probable, however, that



by collecting and sowing the best and most perfect of our own produce, this expensive practice may be rendered unnecessary. By similar attention most of the different sorts of oats are also capable of being greatly improved both in the quality and appearance of the grain.

When this sort of grain is cultivated on such leys as are newly broken up, there may frequently be danger, especially where the land has been long in the state of grass, both from the destructive attacks of insects, and the soil becoming too light, open, and porous, from the decay of the grassy material, for the support of the plants. The first may probably in some measure be obviated, by eating such lands very closely with sheep previous to their being broken up, as by such a method the ova of such insects may be much destroyed, and their propagation prevented. And the treading the crops by sheep, as well as the roller, may likewise be beneficial in both respects. Horses have also been turned in for the same purpose by some cultivators. For the above reasons, it has been suggested as improper to put oat crops in on newly broken up land, or even in the second year's cultivation of them, or what in some districts is termed a *lea breech*. Peas and Beans, according to the nature of the soil, are, as has been seen, generally considered as the most proper sorts of crops in these cases. It is mostly considered by writers on agriculture as a better and more correct practice to sow grass seeds with this crop and barley.

*After-culture.*—The only culture that is necessary for this sort of crop while growing, is that of keeping it as clean and free from weeds as possible, by means of hand-weeding, and the use of the forceps. It is also a practice in some places to pass a light roller over the crop after it is advanced a few inches in height, when the ground has been slightly moistened by rain, by which the cloddiness of the surface is reduced, and the plants in some measure earthed up, and the progress of the crop not only much promoted, but, where thin, the plants rendered more thick upon the land by the tillering that is thus produced.

Oat crops are ready for the scythe, or sickle, when the straw exhibits a yellowish cast, the grain becomes hard, and the chaff opens in such a manner as to render it in some degree naked. This sort of crop does not require to be so dry when put into the stack as those of either wheat or barley.

*Peas.*—This is a crop which is less certain than most others, and even when productive mostly inferior in value, except in particular situations, as near large towns, when produced early for the table, to those of the grain kind. Yet from such crops when full, having much tendency to improve the lands on which they are cultivated, as well as to render them clean and free from weeds, they are cultivated to a considerable extent in many districts of the kingdom. The varieties of peas employed in cultivation are extremely numerous; but those adapted to field culture are generally distinguished into two kinds, the early and the late: of the former are the early *Charlton*, the *golden botspur*, and the common *white*; of the latter, all those of the gray kind, as the *Marlborough gray*, the *born gray*,



the *maple gray*, &c. The first of these sorts is generally considered the best for field husbandry.

This crop may be grown upon almost any sort of soil, but succeeds best on such as are dry and possess a middling degree of lightness, with a tolerably mellow condition, having a portion of calcareous matter in their composition, as without this ingredient peas are said not to fill or ripen so perfectly. Pea crops are mostly put in after wheat, oats, or other kinds of grain. They may likewise succeed clover or sainfoin in many cases with advantage; and on old ley grounds, when newly broken up, where danger is apprehended from the worm, they may often be found a beneficial crop. But after whatever sort of crop peas may be cultivated, it will generally be necessary to have the soil reduced into a tolerable state of pulverisation before they are put in, and, where it can be spared, a portion of manure applied.

On all the more stiff sorts of land this preparation should be given by autumnal ploughing, into a suitable state for the scarifiers and scufflers in the spring so as to be sown without any further ploughing. For this purpose a compost of earth, dung, and lime, may be the most useful, especially where there is little or no calcareous matter in the soil. Pea crops may thus be rendered not only more abundant but better filled, and ripened at an earlier period. Mr. Young, however, objects to the use of any sort of manure for this crop, as where the land is in a good condition and the peas put in upon a layer they do not stand in need of it, large crops being produced without any. Besides, "dung makes them run to long straw, and that is not favourable for podding productively." It also encourages weeds which cannot, from the nature of the crop, be eradicated in the advanced stages of its growth.

*Time of Sowing.*—In sowing this kind of crop, much must depend upon the intentions of the cultivator: when the peas are intended for podding, in order to be sent green to the market, which may be the most advantageous appropriation of the crop near large towns, where they can be readily disposed of, they should be put in succession at the distance of ten days or a fortnight from about the middle of January to the latter end of March, beginning with the lands that are most dry and mellow, and proceeding to such as are more moist and heavy. In this mode of culture regular supplies may be kept up for the daily consumption of the markets. The white early sorts are in these cases to be employed. It is, however, the practice in some of the southern districts, in order to have them more early, to sow the seed in the autumn, at a little after Michaelmas. This from the frosts during the winter, is often, however, a dangerous method, and should perhaps never be attempted except where the land lies extremely dry and warm, and is very rich in quality. In this case the hardy hog kind is the most proper. But for the general crops, when the cultivator has no view of the above kind, they may be sown as early in March as the soil can be put into a proper state of preparation. In these cases the gray sorts are mostly employed. When the seed is put in at a later period, as in April, the white or more



early kind should constantly be preferred, as the produce becomes ripe more early, which is a matter of importance in pea crops.

*Seed.*—The proportion of seed must vary according to the difference of the circumstances under which the crop is cultivated, the manner in which it is put in, and the intention with which it is grown. When the seed is put in on rich ground in the autumn, with the design of pulling the pods green, it may be in the quantity of three bushels and a half or four bushels to the acre; a larger proportion than in other cases being generally allowed. The peas in those cases should be put in in rows, at the distance of about three feet from each other, in order that proper cultivation may be applied afterwards. This mode of practice is common about Dartford in Kent, where the green pea system of husbandry is carried on extensively and with much profit to the farmer. But for the general sowing, when the land is in tolerable condition, from three to three bushels and a half is the common allowance, the earlier sowings requiring rather the most seed. Mr. Young mentions two bushels and a half as the usual quantity to the acre in planting every flag. And where they are drilled at larger distances six or seven pecks may be sufficient. Some have only employed one bushel, but that he supposes too small. In our experience, however, there has always appeared an advantage in having these crops rather thickly sown.

If the view of the cultivator in the growth of pea crops be chiefly that of cleaning and ameliorating the land for the reception of other sorts of crops, as those of grain, turnips, &c. or the producing much straw, a larger quantity of seed may be useful, as by that means the surface of the soil may be more perfectly covered, and a more close and stagnated state of the air produced upon it in consequence; at the same time that the plants are drawn up to a greater length of stem or straw, by which the land will be greatly mellowed and enriched, and the small weeds smothered and destroyed at the time that a larger proportion of fodder is produced. But in cases where the principal object is that of the crop of corn that is to follow, the proportion of seed may be less, as in that way there will be a more free circulation of air, and a more perfect admission of light and heat from the sun, for the growth and maturation of the pea crop, and at the same time less exhaustion of the soil. It is usual in these cases, in many districts, to put the seed into the ground in the broadcast method; but the drill or row system is constantly to be preferred, as being more regular, saving considerably in the proportion of seed, and admitting of cultivation afterwards with more ease and advantage. In this last method two bushels, or two bushels and a half, may often be a sufficient allowance of seed. Different implements have been contrived for this use, but the most convenient is probably a small light sort of wheel-plough, to the body of which a sort of seed-box is attached, through the bottom of which the axis of a light wheel passes, by which the sowing is regulated, and which is pulled up and prevented from letting the peas be deposited at the ends of the ridges, or other places, as in turning by a string attached to the handle. It may be conveniently employed with one or two horses.



The proper distance of drilling this kind of crop is mostly in equidistant rows at about twelve or sixteen inches for hand-hoeing; but where the horse hoe is employed, from two to three feet; and the depth to which the seed is deposited, from two to three inches. In Norfolk they never drill peas at a greater distance than nine inches. When they are dibbled they plant two rows on a flag, so that they cannot be above four inches from each other. In some districts the seed is put in by the hand into drills mostly made crossways of the ridges, but occasionally in the direction of them, at the distance of about fifteen inches from each other, and afterwards covered in by means of hoes. In some instances, also, a bush-harrow is drawn over the surface, by which the land is rendered smooth and even.

Where this sort of crop is cultivated on a ley preparation, the best method is probably, to dibble the seed in. This is the practice constantly followed by the best cultivators in some districts. In some of the southern districts this is done in two rows on every flag of nine or ten inches in breadth, and sometimes only in one row in the same space. Where horse-hoeing is practised or much hand-hoeing to be given, double rows at nine inches with eighteen inches intervals answer very well, in Mr. Young's opinion, but the greatest crops he has seen have been from planting every flag.

*After-culture.*—The use of the hoe in stirring the intervals and earthing up the young plants where the crop is put in in rows by the drill or dibble, is of essential advantage in promoting their growth, and protecting them from the injuries of the season. Where the horse hoe is made use of, the first operation may turn the earth from the rows, and the latter lay it up to them by splitting the intervals. Where the method of hand-culture prevails, it is the general custom to have recourse to two hoeings; the first when the plants are about two or three inches in height, and again just before the period in which they come into blossom. In this way the vigorous vegetation of the young crop is secured, and a fresh supply of nourishment afforded for the setting of the pods and the filling of the peas. At the last of these operations, the rows should be laid down, and the earth well placed up to them, the weeds being previously extirpated by hand labour. In some parts of Kent, where this sort of crop is much grown, it is the practice, when the distance of the rows is sufficiently great, to prevent the vegetation of weeds, and forward the growth of the pea crops, by occasional *edge-hoeing*, and the use of the break-harrow, the mould being laid up to the roots of the plants at the last operation, by fixing a piece of wood to the harrow. This should, however, only be laid up on one side, the peas being always placed to that which is the most fully exposed to the effects of the sun. The edge-hoeing is performed at the rate of from two to three shillings the acre, according to the nature of the land.

It is frequently a practice with the large cultivators of early green pea crops, in the neighbourhood of London, to dispose of them, by the acre, to inferior persons, who procure the *podders*; but the smaller farmers for the most part provide this description of people themselves, who generally apply at the proper season for the purpose. The business of picking or podding the peas is usually performed by



the labourers at a fixed price for the sack, of four heaped bushels. The number of this sort of persons is generally in the proportion of about four to the acre, the labour proceeding on the Sundays as well as other days. After this they are loaded into carts, and sent off at suitable times, according to the distance of situation, so as to be delivered to the salesmen in the different markets, from about three to five o'clock in the morning. In many cases in other parts, the early gatherings are, however, sent to the markets in half-bushel sieves, and are frequently disposed of at the high price of five shillings the sieve; but at the after periods they are usually conveyed in sacks of a narrow form, made for the purpose, which contain about three bushels in each, which, in the more early parts of the season, often fetch twelve or fourteen shillings the sack, but afterwards mostly decline considerably, in some seasons so much as scarcely to repay the expenses. This sort of crop affords the most profit in such pea seasons as are inclined to be cool, as under such circumstances the peas are most retarded in their maturation or ripening, and of course the markets kept from being over-abundantly supplied.

The expense of gathering green peas is different, according to the difficulty of procuring podders, the bulk or abundance of the crops, and the kind of pea or size of the pods. Those of the larger sort, such as the marrowfats, being in the county of Middlesex about one shilling, and those of the smaller kinds, as the Charlton, from fifteen to eighteen-pence, the sack. In Kent the usual price is about fourteen-pence the sack for podding, one shilling for conveying them to the market, and three-pence the sack for the salesman.

The produce of both the early and late pea crops vary much according to the nature of the season, and many other circumstances. The average of the early crops in Middlesex it is supposed, by the author of the Report of that district, to be from about twenty-five to thirty sacks the acre, which, selling at from eight to eighteen shillings the sack, afford about eighteen pounds the acre. The author of the Synopsis of Husbandry, however, states the produce about Dartford, in the county of Kent, at about forty sacks the acre, though he says fifty have sometimes been gathered from that space of land.

But for the later crops that stand to ripen, it is supposed by some to be from three and a half to four quarters the acre; others, however, imagine the average of any two crops together not more than about twelve bushels. And that on the whole, if the value of the produce be merely attended to, it may be considered as a less profitable crop than most others. As a means of ameliorating and improving the soil, at the same time it is, however, to be esteemed as of great value. The chief signs of the healthy and vigorous vegetation of pea crops are those of their leaves possessing a fine bloom of a bluish cast, and having the outermost large leaves of the blossom extending backwards.

In the late or general pea crops, after they are reaped or rather cut up by means of a hook, with a sharp edge, it is the usual practice to put them up into small heaps, termed *wads*, which are formed by setting small parcels against each other, in order that they may be more perfectly dried both in the seed and stem, and be kept from



being injured by the moisture of the ground. But in the early crops the haulm is hooked up into loose open heaps, which, as soon as they are perfectly dry are removed from the ground and put into stacks for the purpose of being converted to the food of animals, on which they are said to thrive nearly as well as on hay. When intended for horses, the best method would seem to be that of having them cut into chaff and mixed with their other food.

Where the nature of the soil is dry and warm, and the pea crop of a sufficiently forward kind, it may be easy to obtain a crop of turnips from the same land in the same year. But in this view it is the best practice to put the crops in in the row method, and keep them perfectly clean by means of attentive hand and horse-hoeing; as in that way the land will be in such a state of preparation for the turnips, as only to require a slight ploughing, which may be done as fast as the pea crop is removed, and the turnip seed harrowed in as quickly as possible upon the newly turned up earth. In some particular districts a third crop is even put into the same land, the turnips being sold off in the autumn and replaced by *collards*, for the purpose of greens in the following spring. This, according to Mr. Middleton, is the practice in some places in Middlesex. It is a method of cultivation that can, however, only be attempted on the warm and fertile kinds of turnip soil, and where the pea crops are early; on the cold, heavy, and wet descriptions of land, it is obviously impracticable. With the marrowfat and other late sorts of peas, the usual practice is to either prepare the land for wheat, or to put in crops of savoys, or other late sorts of cabbages, which are methods of husbandry that may often be had recourse to, even on the more heavy sorts of land, with success.

*Beans.*—This is a species of crop that may be cultivated to much advantage on all the more heavy wet kinds of land, which are improper for most other sorts of crops, both on account of the utility of the produce, and the improvement that is effected in the nature of such soils; as by this means, as has been already seen, the ground may in many cases be rendered proper for the growth of wheat, without having recourse, as has been usually done, to the uneconomical practice of preparing it by a naked fallow.

There are different kinds of beans cultivated in different districts, according to the intentions of the farmers, and the nature of the soils; but they may be sufficiently distinguished by dividing of them into field and garden beans. Of the first sort the common horse-bean is the most generally cultivated on the strong lands, as it is found to a greater height in the stem, and of course to cover the surface of the land more effectually. The tick bean is, however, supposed by some cultivators to afford a larger produce. The large ticks are the sort mostly grown in the county of Kent, where the bean husbandry is practised to some extent; but in Essex, where the system of cultivating beans also prevails in a considerable degree, the small ticks are held in the highest estimation, as on the strong lands of that district they are mostly found to afford an abundant produce. And in the market this is the sort of bean that generally fetches the best price.



Some of the latter or garden kinds have lately been introduced into the field with considerable advantage in particular districts. Of these the mazagan and mumford, the long pod, and the Windsor, are the sorts that are in general cultivated. The first is an early kind that does not grow to any great height, seldom more than about two feet. The stem is slender, but mostly well beset with pods, which contain beans of rather a small size. This sort of bean, from its not growing tall, and having but a slender stem, may probably be grown with profit on the less strong and heavy sorts of ground. It has also the property of becoming ripe, more early than any of the other garden beans. The mumford bean is also proper on the same sort of land. But the long pod is of a much taller growth, and considerably more strength of stem; it consequently requires greater depth and strength of soil for its advantageous culture. It is a sort of bean that affords a large produce where the land is suitable to its growth. The Windsor bean is of a still larger kind than the long-pod, the seed approaching to somewhat the square form. It grows strong and tall like the long-pod kind, but seldom yields so large a produce. These large kind of beans are rarely, however, cultivated in the field, except in the vicinity of large towns, where they can be sold in the pods green.

This is a sort of crop that thrives equally well in the stiff clayey lands, and those of the strong loamy kinds. The soil of the lands, where bean crops succeeds to the greatest advantage, is generally of a good depth; as in such the roots are enabled to get down so as to be capable of supplying themselves with a suitable proportion of nourishment, which cannot be the case where the ground has a thin soil.

Bean crops are grown before wheat and after oats, as well as on such lands as has been newly broken up from the state of ley. And also after clover and other seeds. On the leys they may be cultivated with great propriety and advantage where danger is apprehended of corn crops being injured by the attacks of the grub or other insects.

The common method of preparing the soil for the reception of bean crops is merely by giving one ploughing at the period when the seed is put into the ground in the spring months. But it is a much better practice to plough the land into ridglets of about two feet six inches or three feet in width, as early as possible in the autumn, after the manure has been applied, which should constantly be laid on when beans are sown after grain crops; in which state it should remain until the period at which the beans are to be put in. By the use of a portion of manure in this manner, the crops are rendered more strong and vigorous in their growth, at the same time that the branching of their lateral shoots is considerably promoted. There is no crop to which manure is more usefully applied than to this. In these cases the lands should always be ploughed into that form which suits the particular method of sowing which is to be practised: where the crops are to be drilled, they should have the exact breadth which suits the drill-machine; but where dibbling is made use of, that which is proper for the operation of the scuffler or scarifier. Proper attention should likewise be paid to having the business of



water furrowing well performed in the autumn at the time of ploughing the land.

*Time of Sowing.*—The season of putting this crop into the ground must depend in some measure upon the nature of the climate and situation. In the more mild and less exposed places, in the southern districts, they may be put into the earth with propriety during the whole of the month of January; and in such as are more exposed, as early in February as the business can be accomplished with propriety. But in the more northern parts of the kingdom, a later period may be more suitable, as in March. When the period of planting is delayed too long, there may often be danger of the crops not being sufficiently established in the soil before the weather becomes too hot and parching. And, on the contrary, when they are set too early there may be danger from the frosts, which, when severe, are known to injure them greatly at the time they first shew themselves above the surface of the ground, and when accompanied by sudden thaws to be capable of wholly destroying them.

*Seed.*—The proportion of seed that may be necessary, must, of course, be different, according to the nature of the soil, the period of putting the crop into the ground, and the manner in which the business is performed. Where the broadcast method is pursued, and the land is of the medium bean kind, from three and a half to four bushels is the quantity that is most commonly allowed to the acre. This mode of practice should, however, never be attempted when the others can be had recourse to. Under other methods of putting in the beans, a much less proportion of seed is, however, required, the quantity varying according to the distance of planting from two to three bushels and a half to the acre, or in some cases perhaps rather more, of the small sorts, and five or six of the large kinds. When planted in rows at the distance of two and a half feet the quantity of seed that is most proper has been found to be about two bushels to the acre; but when put in rows at the distance of only fifteen or eighteen inches, it will be three and a half bushels, or perhaps rather more.

The manner of putting this crop into the soil differs considerably in different districts. In some the method of sowing broadcast is still in use; but in this the seed is liable to be left uncovered on the surface of the land, or covered so lightly that the bean plants are incapable of vegetating in a proper manner, from which the crop often becomes weak and feeble in its early growth, and seldom acquires proper strength afterwards. Besides, in this method, from the irregularity of the crop, there is great danger of its being injured by the growth of weeds, as they cannot be conveniently destroyed by the hoe. In others they are first sown over the land, and then ploughed in with a light furrow.

It is the custom in some of the more southern districts to plant this kind of crop in rows, by means of a line and dibble, which, though an expensive practice, is greatly preferable to the above, both in admitting of the land being kept clean, and in the economy of seed. In this way the rows are usually marked out to the distance of a foot from each other, and the beans deposited about two



inches apart, the lines being stretched across the ridges, which are formed of different breadths, according to the circumstances of the land, but in many cases about six feet over. In this mode, after one row is planted, the pegs to which the lines are attached are moved exactly to the distance that is requisite until the whole field is finished. It is an excellent method for layers. The expense of this mode of setting beans is generally about nine-pence or a shilling the peck. In some places it is done by the gallon at the rate of about four-pence. In performing this business care must constantly be taken by the employer to see that the beans are regularly deposited in the holes to a suitable depth, and not thrown away or otherwise wasted, in order to obtain greater wages. After the beans are thus deposited, a bush-harrow or very short-tined common harrow, drawn by horses in the furrows, is generally passed over the ground in order to cover them. In some parts of Essex they have a practice, of dibbling beans on two bout ridges of three feet in breadth, in double rows on the crowns nine inches apart, leaving an interval of twenty-seven.

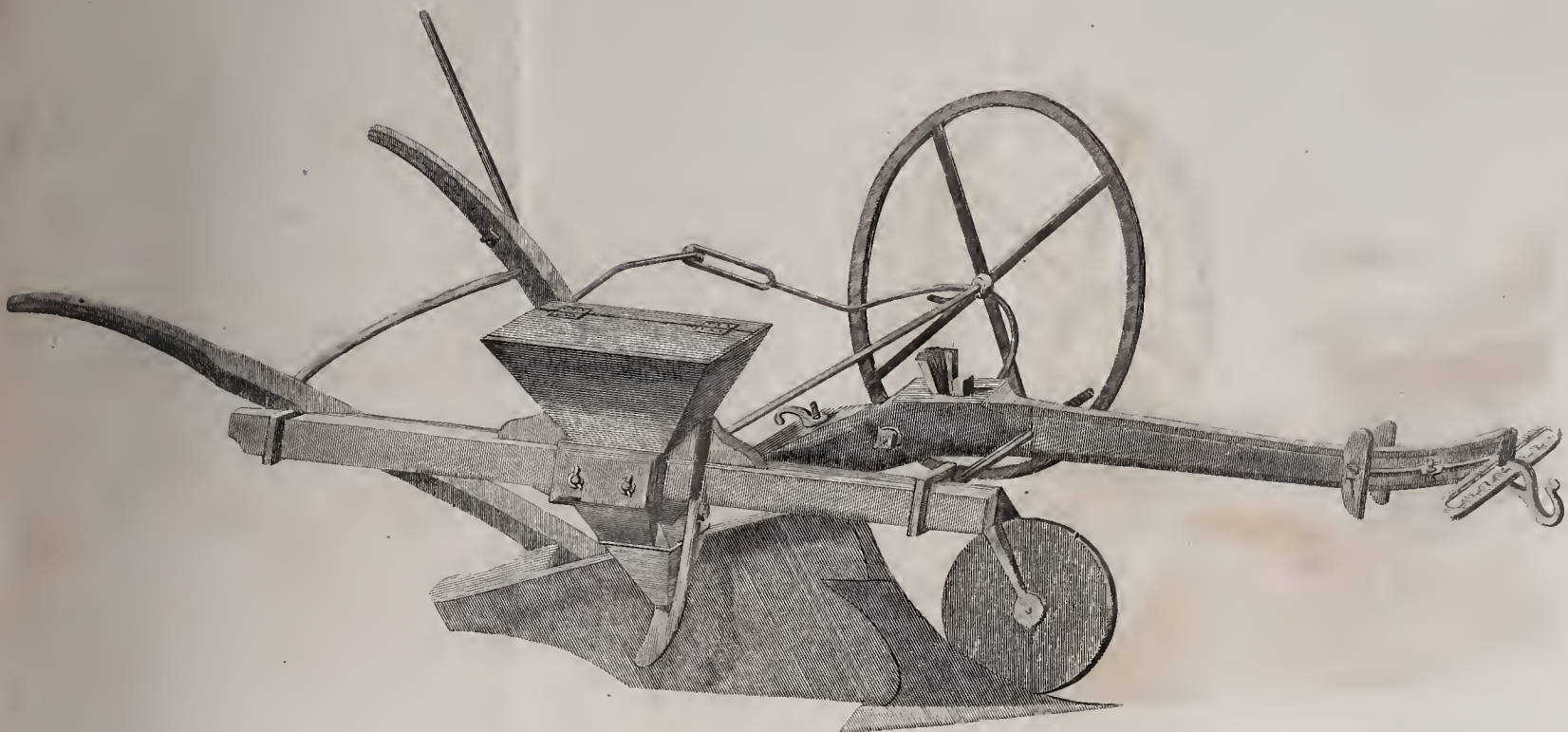
The Kentish farmers have however a much neater and more expeditious method of sowing beans, which is, to strike out furrows in the proportion of about eleven to a rod in breadth, in which the seed is thinly deposited by means of a sowing-box, which is held by a person following the striking-plough, and who, by slightly agitating it when filled with beans, drops them with regularity into the furrows as they are formed. The seed is then covered by harrowing down the inequalities of the ground. It is stated that in this method with two men and two or three horses to the plough, a person to manage the box, and a boy with two horses to perform the business of harrowing, the space of three acres may be completed in the course of a day.

In accomplishing this business, it is, however, the custom of some to make use of a drill-plough, and in the annexed plate is a bean drill the invention of Mr. Amos, which Mr. Young has recommended as having much merit. It delivers the beans in a different manner from many others, as it scatters the seed on the slice of the preceding furrow, while they mostly drop it into the furrow. It has been extensively employed by the inventor; and on wet lands must be highly useful, by depositing the seed while the land is ploughing, and thereby preventing the necessity of going a second time upon it, which is often injurious.

The drilling of this sort of crop is performed at different distances, as from twelve to twenty-four inches. The practice in Suffolk is frequently twelve, but which on good land is too near, as the stems are drawn up weak and without pods below. Eighteen inches is a more proper distance. In Kent fourteen and sixteen inches are in use by many cultivators. The distance should however vary with the nature of the land, the largest being given where the soil is the richest. Twenty-seven inches is seldom too much. Mr. Young mentions a particular custom in Berkshire, which is that of planting them in clusters of four or five beans in a hole, at the distance of nine inches, the spaces between the rows being proportioned to the



BEAN DRILL. PLOUGH.









goodness of the land. In this way they have large and productive crops.

From the nature of the root of the bean plant, it has been inferred, that it should constantly be planted to a good depth in the soil, not less than five or six inches below the settled surface of the land, as by the lateral fibres which constantly pass off from the portion of root above the seed to the upper part of the ground, large supplies of nourishment may be conveyed to the plants, which could not be the case when put in more superficially, as that part of the root below the seed is not furnished with such fibres.

The putting in of this kind of seed by the drill is a practice that may be performed with the most benefit and success on the drier and more mellow kinds of bean lands that have been some time in a state of cultivation; but on the wet and strong grounds it is frequently a difficult and troublesome process; it is therefore probably a better method to dibble them in upon the seed earth, especially in breaking them up from a ley, as where they have been previously ploughed, early tillage in the spring, however necessary, is impossible, it being only capable of being accomplished on a ley. In these cases a row may be put in by the dibble on every second furrow, by which they will be equidistant eighteen inches: or by dibbling two furrows together and missing one they will be in double rows at nine inches, with intervals of eighteen, which is equal to one row at every thirteen and a half inches. It is the custom in Norfolk to dibble beans in the same manner as the peas, &c. except that they never set more than one hole on a flag. The plants are perhaps eight inches asunder, but are rarely buried above an inch. They turn sheep in when the beans are two or three inches high, to crop any grass which may have got up between the furrows. Sheep do not eat the beans, or in any degree injure them. With this mode of management they can grow from ten to fourteen coombs an acre. They always hand-hoe beans twice and sometimes thrice. Where the ground is very stiff and hard, they harrow once or twice in a place before they dibble.

*After-culture.*—Where the broadcast method of putting in the crop prevails, little or no advantage can be afforded to it afterwards which is a circumstance that renders that practice improper in most cases, as few crops derive more benefit from after-management than those of beans. In some instances, indeed, the large weeds are removed by a hoe or hook, and in others sheep have been turned in for the same purpose, as from their dislike to the bean plant they are said not to injure the crop either by eating the young plants or breaking them off. The practice is however too hazardous to be attempted except in particular cases. But where the crop is planted in rows, either by the drill, dibble, or other methods, the ground admits of being frequently stirred and laid to the roots of the plants by the hand or horse-hoe, and of being kept perfectly clean by weeding; upon the proper performance of all which the perfection of the bean husbandry consists. It has indeed been well observed that these different operations are absolutely essential, and that where a wheat crop is to follow, the more money there is bestowed in this



way, the better it is for the farmer; those of Kent being dissatisfied if it does not amount to from seventeen to twenty shillings the acre, as their wheat crop is sure to suffer where there has been any neglect in these processes, beans well managed by the hoe being an excellent preparation for wheat crops.

In the methods of planting in rows, at the distances of fifteen or twenty-four as well as on ridges at thirty inches, the horse-hoe may be most conveniently employed, but for narrower spaces the hand-hoe can only be made use of. The practice in Middlesex is, when the crops are about five or six inches high, to constantly hand-hoe the intervals, and clean the rows by weeding, and to repeat the same operations about the time of their coming into blossom, in which the earth should be carefully brought up to the roots of the plants, which has much effect, by the quantity of nourishment thus provided, in promoting the setting as well as filling of the pods. It has also been remarked, that, where the ground is in a situation to admit of the action of a small light plough, or a horse-hoe, to earth up the rows, great benefit may be thus produced, but that on the clayey loams this is only capable of being performed for a little time after they have been well moistened with rain. In the county of Kent it is frequently the custom to apply the roller and the harrow to the bean crops about the middle or latter end of March, by the first of which the cloddy parts are broken down and reduced, while the latter immediately following renders the baked surface-mould fine and powdery; by which means new supplies of nourishment are provided, and the advancement of the young plants greatly promoted. At no distant period after this the beans are edge-hoed, and then braked, the latter of which is a method of practise chiefly confined to that district, and which is considered by some cultivators as much preferable to the application of the hoe to the whole surface of the spaces between the rows, not only as being performed at a much less expense, but on account of its being more effectual in the removal of weeds, and providing more abundant supplies of such substances as contribute to the nutrition of plants, by loosening and newly aerating the surface-mould of the soil, as well as throwing it up to the roots of the beans. It is customary in many parts to repeat this process every fortnight or three weeks, from the early part of May till the season at which the crop blooms. And it is observed, that the earthing up may be accomplished with facility by the above implement, merely by fixing a small piece of wood on the *strig* of it, the diameter of which regulates the height of earthing up the stems of the beans as they advance in growth. In other bean districts, as in Berkshire, where they sow triple rows at eight or nine inches, and leave intervals of two furrows width, it is the practice to plough two furrows up each interval from the beans, making a ridge in the middle, by a small light plough contrived for the purpose, which is drawn by one horse, a moist season being chosen for the business. After this the ridges are to be harrowed by means of a triangular harrow, by which the superficial parts of the soil are rendered light and mellow, so as to admit the lateral fibres to shoot in it with facility, and draw forth support for the crop more effectually.



ally. Both in May and June the shims and hand-hoes or weeding with the hand should be kept well at work when the weather is dry enough for the purpose. In the latter, the use of the Berkshire shims of breadths proper for the work with cutting plates suited to the intervals as well as the state of growth of the crops, should be had recourse to. In the last horse-hoeings in July, whether the shim or double mould-boarded plough be employed, great care is necessary from the height of the stems. Mr. Young advises that they should be drawn by a whipple-tree as short as will permit the horse to work, hung upon a spring fixture at the end of the beam, by which the whipple is raised to such a height that little injury is done. It may be regulated to the height or growth of the crops by a wheel. The block of the shim in this case should be in a longitudinal position with the rows, to prevent the breaking of the stems. The earthing up must now be well performed, and all weeds effectually removed by the hand or small hoe.

In some districts it is the practice to sow beans and peas together, or what is termed *blendings*; but this is mostly an improper method, as plants of different sorts never ripen well or equally together.

In such summers as are dry, beans are frequently liable to be much injured by the attacks of the black fly, or what is often termed the *dolphin*, the whole field in particular cases being in danger of being destroyed in the course of a few days. In order to prevent this mischief, it is the practice in some places to cut off the tops by means of a scythe or other sharp implement, as it is mostly on the tops of the plants that the insect first appears. When this method is adopted, it should be performed on the very first appearance of the fly, otherwise little benefit can be produced; as perhaps by removing the first insects that shew themselves, their propagation may in some degree be prevented.

The blight likewise sometimes proves destructive to the bean crops about June or July, when the weather is hot and foggy in the day with cold nights. In this case the blossoms fall off, and no pods are formed. But though much injury may be done in this way, the crops sometimes turn out better than was expected; they should not therefore be given up too hastily.

The ripening of the beans is shewn by the *Pods* or *kids* turning of a black colour, which mostly happens about the latter end of August, after which they begin to open at the ends: but they should always be cut or drawn up a week or ten days before this would happen; for though in some parts of the crop the kids may not be perfectly turned, this should not delay the business, as they will become ripe and hard after being cut or drawn up by the roots, by setting the sheaves upright, and leaving them exposed to the influence of the sun and air for seven or eight days. When cut or drawn up some time before they are in a suitable state of maturation, they shrink and become wrinkled; and if it be done when they are too ripe, they are liable to be lost by being shed in the field: it is a better practice, however, to reap them before they are fully ripe, than to let them stand until they are over-maturated. When they have become too much ripened, it is recommended to cut or draw them



up while the dew is upon them, and to convey them in the same state to the stack. The parts of the crop that are not so perfectly ripened may be cut or pulled during the dry part of the day.

When the season is moist, and the land of a good quality, bean crops continue to proceed in their growth to a late period, and the pods formed on the upper parts of the stems remain green when those on the lower parts are in a perfectly ripe state. In such cases it is not necessary to delay the business of removing the crop, as by their remaining a little longer in the field no injury will be done either in the stack or to the sample. Indeed, as this sort of vegetable is extremely succulent, it is proper in most cases to let it remain out after being cut for a considerable length of time, in order that the excessive moisture may be fully dissipated, otherwise the sample may sustain great injury from mouldiness, and taking on too great a heat in the stack. It may also on these accounts be necessary for them to remain in the stack for some time before they are threshed out.

There are different methods of removing this sort of crop from the land: in some districts it is the practice to reap or cut it close to the ground with a sharp hook contrived for the purpose; in others it is mown; and in a few it is pulled up by the roots, being afterwards bound up into pretty large sheaves by woollen yarn, old ropes, tarred cord, or straw ropes, and set up three or four together.

The quantity of produce of beans is different according to the nature of the soil, the kind of seed, the method of planting, and the exactness with which the after-culture of the crop is conducted. In Middlesex it is stated to be from three and a half to four quarters the acre; and in Yorkshire, when cultivated as a preparation for wheat, from four to six quarters the acre; but where the crop precedes a fallow, only from two to three quarters. In other districts, as in Kent, where the bean husbandry is more perfect, the common tick beans are said to afford from two to six quarters, according to circumstances; the mazagan, and other small beans of the same sort, from three to five quarters, and sometimes considerably more; and the Windsor, long-pod, and other large sorts of beans, from three or four to ten quarters the acre. Taking it throughout the whole kingdom, it is asserted by an able writer to vary from sixteen to forty bushels the acre, but that a good average crop can seldom be stated at more than twenty.

The straw of this crop is useful for various purposes. When well broken by threshing, it forms a durable litter for working horses, as well as hogs and other animals. It is also asserted to be a hearty and nutritious food for cattle during the winter season; and that both oxen and horses, when not wrought, thrive well upon it. And as the reduced parts, or what is termed the *caving-chaff*, have been found valuable as a manger food for the labouring teams when blended with other substances, it is probable that in particular cases the stems might be cut into chaff with advantage. But when made use of in these methods, it should be taken as fresh as possible from the flail.

The smaller kinds of beans are principally employed in the feed-



ing of horses, hogs, and other animals; and as they contain a third more meal in a given portion than oats, and at the same time probably afford a more durable nourishment, it must be economical to make use of them in the feeding of labouring horses. And on the same principles they must be advantageous when used in the fattening of cattle, &c. But when hogs are fed with this sort of food, it is asserted that the pork is indifferent from the meat becoming hard, though for bacon it is extremely good.

Where the beans are to prepare the land for wheat, it is essentially necessary that the stubble, with such weeds as may have been left, should be removed as expeditiously as possible after the beans are taken off. This purpose is well accomplished in some bean districts, and at the same time a great degree of pulverisation effected, by *spuddling* the land with a kind of plough, to the share of which an iron plate is attached crossways, at the distance of about four or five inches from the point, the same axle-tree and wheels being employed as were used in striking the furrows. By this implement, with two horses and a man, it is asserted three acres of land may be finished in a day, by setting the point of the share in the intervals in such a manner as that the plate or fin may extend to a row on each side. After this operation has been performed, by passing the harrow and the roller over the land, the whole is cleared with little expense, and left ready for the seed earth. On the more thin and light kinds of soils, whether of the chalky or gravelly sort, such a process may, however, be improper, as such lands may be rendered too open and porous for wheat crops by it.

## SECTION XIV.

### *Cultivation of Arable Land, Root and Plant Crops.*

**I**N the growth of most sorts of crops of these kinds, a fine degree of pulverisation and mellowness is of great advantage, as it is principally by these means, and those of preserving a perfect state of cleanness and vegetation in the plants, by frequent proper stirring and changing the earth about them, that the most full and abundant crops can be produced.

*Potatloe.*—The cultivation of this highly valuable vegetable has rapidly increased within these last twenty years, so that it may now be considered as standing next to wheat in respect to human food.

Though the varieties of this plant that are cultivated are extremely numerous on account of their being raised continually from seed, there does not appear to be more than two distinct species; the



*red-rooted*, or that which bears a purple blossom or flower, and the *white-rooted*, or that which has a white flower.

It is suggested by an intelligent practical writer, that much still remains to be performed in respect to the improvement of the quality and productiveness of this plant, by raising it from seed, and, that, in selecting proper plants from seedling potatoes, two circumstances are necessary to be attended to; which are, the quality of the potatoe, and its productiveness. In cases where these different properties are combined in the same plant, there can be no difficulty in deciding in its favour.

The varieties of this root, that are at present in cultivation in different parts of the kingdom, are extremely numerous. In Lancashire, where the potatoe husbandry is well understood and largely practised, there are, according to the account of Mr. Kirkpatrick, upwards of twenty sorts of the more early kinds, and more than half as many of those of the late.

The *old winter red* is an excellent variety for the table in the spring, when most other sorts have lost their flavour, and are become unfit for use by sprouting. It is said likewise to have the property of not being liable to the curl. The *blacks* are likewise a late sort, which keep well till about August.

As cattle potatoes, the *ox noble* and the *cluster* are the varieties principally cultivated, as they are both large in size and very productive. The *white* sorts are however most proper for being made use of in the early part of the season. And the *pink-eyes* are of a hardy nature, and probably capable of being grown with less perfect culture than most of the other varieties. The *royal* or *Cumberland early* is very productive and of a large size, with a good flavour; and besides, it ripens early.

The soil in which this root is capable of being produced to the greatest advantage is a rich loam of the light sandy kind, that possesses a medium degree of moisture. They may, however, be grown with success on lands that are much stronger, where proper attention is bestowed in their culture. On grounds of the peat-moss kind they have likewise been found to succeed in a high degree. In Mr. Townley's experiments, though the more stiff and tenacious sort of lands do not seem to have been tried, the produce appears to have been the largest on the strong kinds of soil; but, in every case, it is essential that they be dry, the stagnation of moisture being highly detrimental to the growth of this root.

It may be the most advantageous practice in the field culture of this plant to put in crops of this kind in the more heavy adhesive soils, after beans, cabbage, or other vegetables of the same nature, that require manure; and in those of the more light descriptions, after peas, such grain crops as demand a fineness of tilth, and on such lands as are under the state of fallow.

It is a practice in some districts to raise potatoes on the *ley* grounds when first broken up; but this can seldom be an advantageous method, except where they are planted in what is termed the *lazy bed* manner, or by the dibble in the middle of the furrow



slice, in which, from the large quantity of loose mould by which the sets are covered, good crops may be produced, as is often the case in Lancashire, where this mode of planting was formerly much in use. It has likewise been suggested, that potatoes may be grown in a very beneficial manner on sward lands, by ploughing them very thin, and putting the sets in under furrow. And in these cases Mr. Somerville advises, that a plough be made use of that only just pares off the sward, and deposits it flat in the bottom of the furrow, the root side uppermost; the sets being placed by the planter on the inverted sod immediately after this plough, and then covered with the fine mould from below by a common plough. But the best method in these cases is probably to have the land prepared by paring and burning. But whatever may be the nature of the soil on which the potatoe is planted, it should be reduced by the operation of the plough, spade, or harrow, into as fine and mellow a condition as possible, in order that the earth may lie so light and porous as to admit of the proper swelling of its knobby roots. In most districts where this root is much cultivated it is the custom to give the land that is intended for this crop one or two ploughings in the latter part of the autumn, and, after it has been thus exposed to the influence of the atmosphere during the winter, in the spring at the time of planting to reduce the cloddy surface well by means of harrowing, after which the ground will be in a suitable condition for receiving the sets. On the marsh lands in the West Riding of Yorkshire, where the cultivation of the potatoe in the field is carried on to a considerable extent, the lands that are intended to be cropped with this root, whether the preceding crops have been wheat, beans, or oats, are ploughed up at Christmas, or as soon after as the work can be done; and in the middle of April, if the soil has become sufficiently dry, it is harrowed well at intervals, occasionally using the roller, until the whole has been brought into a perfectly fine state. After this the land is to be ridged up, in order to be planted.

As the potatoe forms its produce below the ground, and is of very luxuriant growth as well as considerable increase, it can but in few cases be cultivated to advantage without the assistance of manure. And as it requires that the soil should be kept free from the stagnation of moisture, as well as light and open, it may be the most advantageous method to make use of the stable kind in its long or more littery condition, as by this means the ground, especially when of the wet kind, may be kept more light and open, as well as more free from injurious moisture, and at the same time a more durable supply of nourishment be provided for the crop, by its more gradual decay. Where this sort of manure cannot be provided in sufficient quantity, old thatch, the strawy litter from the fold-yard, or any similar material may be employed. But in the light sorts of soil, dung in its more putrid reduced condition may be made use of with much propriety, as in such cases the mould is mostly in a sufficiently porous and open state, and they have rarely too much moisture remaining upon them. A great variety of different sorts of manure have been tried by experimenters in the culture



of the potatoe ; but those which have been just described seem to be the best adapted to the crop. Mr. Billingsly, however, seems to recommend *well-rotted* horse-dung, though the long dung is noticed as being the next in value. The nature of the soil in which this was the case is not distinctly mentioned ; it was probably of the sandy kind, in which there can be little doubt but that horse-dung, in a highly reduced state, would be of the most benefit, as a larger proportion of carbonaceous earthy matter would thereby be immediately provided for the growth of the crop, and the ground be more preserved from becoming too dry, light, or porous.

The dung of hogs has also been found, by the experiments of the same cultivator, to be nearly equal to that of the horse, in raising crops of this highly valuable root.

When this sort of crop is cultivated on the stiff and more heavy descriptions of loamy soils, on the principle of keeping the earth light and open by their very gradual decay, in order that the roots may have room to extend themselves, many other substances besides littery dung have been employed. Wheat straw, furze, broom, heath, and other similar matters, after having been in some measure reduced by chopping, are deposited in the drills, and, from their gradual decay, good crops are frequently produced. Clover, tares, vetches, and other succulent vegetable productions, when enclosed in the soil in their green state, at the time of planting, have also been found useful as manure in the growing of crops of this kind.

Peaty or turfy materials have likewise been made use of for the same purpose on different sorts of land. On the light, thin, and open soils, they are asserted to have good effects, in contributing to the nourishment and support of the crop, in rendering them more capable of retaining moisture, and by increasing their staple. And in the heavier soils they become of much use, by keeping them in a more open condition, and thereby allowing the moisture to pass off more readily, and the roots of the plants to swell out in a proper manner.

Whatever sort of manure may be made use of in the growth of potatoes, it is necessary that the quantity be fully sufficient for the purpose of providing not only a suitable bed for the establishment of the roots of the plants, but also for affording a due supply of nourishment during the whole time of their growth, as upon these circumstances the success of the crop seems in a great measure to depend. It is advised that not less than twenty cart-loads, of thirty bushels each, should be applied, as the richer the ground the more abundant the crop ; and that, however strong the soil may be, the farmer should not depend upon it to the exclusion of manure. Mr. Young advises the proportion of from twenty-five to thirty five cubical yards to the acre to be made use of. And where it is very long or littery the quantity of forty.

Where the sets are put in in the drill method, the manure should be deposited as evenly as possible at the bottoms of them ; and in the other modes it must constantly be spread out in a regular manner, in order that the crops may be brought forward with as much uniformity as possible. In raising crops of the early kinds of pota-



atoes, it may be a more advantageous practice to apply the manure for the previous crop; as where the contrary is the case, the haulm or stems of the plants are apt to become too luxuriant, and thereby prevent the roots from acquiring a proper size. Besides, it is probable that the flavour of the potatoe may be better, and the substance less watery.

*Time of planting.*—The putting of this sort of crop into the ground should always be performed in the early spring months, as soon as possible after the danger of frost is over, which, in the more southern districts, is generally from about the middle of March till the latter end of April; and, in the northern ones, it is mostly from about the middle of April until towards the close of May, according to the difference in the state of the climate. The earlier the crop can be got into the ground, the better it becomes, as the potatoes are said to turn out more mealy, and of a finer flavour. Besides, they have a better chance of being taken up and removed from the land, while the season is dry; and there is less risk of injury from moisture and frosts after they are fit for taking up. But at whatever period the crop may be put into the ground, the business should be performed as much as possible when the weather is dry, and the land not too much soaked with moisture, as under such circumstances the early vegetation of the crop always proceeds in a more regular and expeditious manner, by which the produce is generally rendered better in quality and more abundant.

*Seed.*—In the choice of potatoe seed for the purpose of planting, it is necessary to attend to the differences in the varieties, in respect to forwardness, their qualities as food for man or animals, and the variation in their productiveness; as upon the properly adapting these to the nature of the soil and climate, as well as the views of the cultivator, much advantage may probably be obtained in the culture of the crop. It is generally recommended, that the sets should be taken from such potatoes as are the finest and most perfect of their kinds, as by such means better crops may be produced, at the same time that there will be less risk of their being attacked by disease. It may also be of great advantage in the culture of this root, to take the seed or sets from such varieties as have not been too long cultivated, as it has been found, that the continuing the cultivation of the same sorts for some length of time has a tendency not only to injure the quality, but lessen the quantity of the produce.

In respect to the seed or sets, different modes have been advised by different cultivators, some preferring whole potatoes, or large cuttings, while others think small cuttings, sprouts, or even the eyes, the most beneficial. All these different sorts of sets are, indeed, found in practice to produce good crops; though it seems probable, from the various experiments that have been made upon the subject, that the middle-sized whole potatoes, and the large cuttings of large ones, are in general more productive than either the smaller sort of whole potatoes, small cuttings, or the eyes or shoots alone.

It is always necessary, where cuttings are made use of, to take



care that they contain a sufficient proportion of matter about the eyes or *root-buds*, to afford nourishment and support to the plant during the process of germination, and until it be perfectly established in the soil.

On the principle of saving seed in scarce and dear seasons, it has been advised by some to have recourse to the shoots, and, by others, to the eyes only; but the use of these, except under such circumstances, is liable to many objections. Where the shoots are employed, the crops are found to be considerably more backward in becoming ripe, consequently more exposed to the danger of cold winds and frosts about the period of their being taken up; besides, from their being more tender than sets taken from the cuttings of potatoes, they cannot be put into the ground at so early a period. But the most material objection is, in many of the plants being so weak and imperfect in their growth, as to afford little or no produce. Where the plough is made use of in planting them, there may likewise be danger of their being injured by the trampling of the horses, except great care be taken to prevent it. Where the eye or *root-bud* of the potatoe is employed as seed, it is usually cut out of it by a scoop or implement contrived for the purpose, to the thickness of about half a crown. Different implements for effecting this purpose have been contrived, which may be seen in Plate LVIII. But though this mode of sets is said to have been made use of with success by some cultivators, it is probably liable to most of the inconveniences that attend the setting of shoots.

On the whole, though there is reason to suppose, from the various experiments that have been made on the nature of the seed, or sets of potatoes, that the quantity of produce is not, as has been supposed, exactly in proportion to the weight of them, yet that it is in some measure influenced by that circumstance, and their having a suitable number of *root buds*, as well as a due proportion of pulpy material surrounding them, to ensure the perfect evolution and support of the plants in the early stages of their growth, and until they become completely established in the ground.

With respect to the quantity of seed or sets, in general from twenty-five to thirty bushels will be required for the acre, when dibbled in at ten inches distance in every direction, and from eight to twelve when every other furrow is planted at a foot from set to set.

*Methods of Planting.*—In the putting of potatoe crops into the ground, different modes are adopted in different circumstances of soil and situation. On all the more dry and sandy descriptions of land, the surface of the ground should not be raised, but kept as much as possible on the flat; but where the climate is damp, and there is more moisture in the soils, and less danger of their becoming too dry for the perfect growth of the potatoe, and on all the thinner sorts of soils, it may be the most advisable method to raise the land into what is termed one-bout ridges; as, in this way, the depth of the staple is considerably augmented, the manure is more concentrated for the support of the crop, a better bed is provided for the fibrous roots and wires of the plants to establish and extend



themselves in, the danger of stagnant moisture guarded against, and the after-culture of the crops rendered more easy, beneficial and convenient, by which they may be kept more clean and free from weeds, and be earthed up at different times so as to insure the most full and perfect extension of the roots in the fine mould that is thus constantly laid up. And as the whole of the process is capable of being performed by means of the common plough and a horse or two, it is probably the most advantageous where such crops are cultivated on land that has been some time in the state of tillage. Where the ridges are only required to be small, the operation is completed in one bout of the plough, or by going up with one furrow and laying another up to it in returning, so as to produce a ridge in the middle. This is the method that is the most commonly pursued in those districts that are the most engaged in the cultivation of this valuable root.

It is the custom in the Lancashire practice of planting, after the land has been harrowed fine and level on the surface, to make equidistant drills, the length of the field, in doing which, the plough, after making a furrow up the field, must be drawn down again on the contrary side close by the same, throwing the soil equal heights on each side. These drills are made as wide and deep as will make them capable of containing the dung, which is to be laid in the bottom of each. The distance of the drills is such, that when the horses stand in one, each wheel of the cart or tumbril may be in the middle of the next drills on each side. The next operation is to carry in the manure; and as the horses stand in one drill, and each wheel of the cart in a similar situation, the neatness and order of the land is very little injured. The dung is then to be thrown out of the cart in small heaps, sufficient to supply the three drills which the horses and the wheels of the cart occupy, a moderate scattering of which is to be put into the bottom of each. This will be completed in a very short time by persons with forks of two tines.

Where long strawy dung, lately thrown out of the stables or cow-houses, or collected from the farm-yard, can be procured, it is employed. When the drills are thus prepared, the sets are put into them upon the dung about six inches distant from each other. The plough is then to be run on both sides of each drill, to throw the earth which was raised out of it upon the potatoes. This operation will elevate it in the middle, and cause it to lie sloping on each side like the roof of a house. The business is thus complete until the stems of the potatoes begin to make their appearance above ground.

But in the West Riding of Yorkshire, where the culture of the potatoe is well performed, according to the Report of that district, after the land has been properly prepared, the best cultivators begin to ridge it up by ploughing a furrow round it down, and then taking a suitable distance according to the nature and qualities of the soils, as from about two feet eight inches to three feet, such as are rich and fertile requiring more space of ridge than such as are poor and exhausted. The manure, where necessary, is disposed with regularity in rows by means of a labourer with a fork, in the ridges, the potatoe



sets being then placed at suitable distances upon it, and covered by the plough.

The method recommended by other cultivators in the northern parts of the island, after much experience, is, after the ground has undergone a thorough preparation, and is made perfectly level by repeated ploughing and harrowing in different directions, to draw straight parallel furrows by means of a double earth boarded plough, drawn by a single horse, at the distance of two feet and an half from each other. This operation is performed in the most correct manner, by passing the plough twice in the same track, which, when the land lies sloping or uneven, should be down hill the first time. The manure is then brought on in carts from the upper sides of the fields where they are hilly, the horses passing in one furrow, and each of the wheels in others on the different sides; they are then emptied by the drivers, who walk behind them with crooked three-pronged forks constructed for the purpose, leaving it in small heaps in the furrows in which the horses go, in sufficient proportions for the three drills. It is then divided and spread out in the different rows in as equal a manner as possible by women and children, the sets being put in upon it at the distances of about twelve inches from each other, the whole afterwards covered in by the plough, by splitting the ridges betwixt the rows, passing twice in the same track as in opening the furrows for the rows.

There is another method of planting this root, that prevails pretty generally in the more dry districts, which is that of spreading the manure over the whole surface of the land in an equal manner after it has been well prepared by twice ploughing and harrowing; the sets are then planted in every third furrow, the dung and fine mould being turned upon them by the plough. This mode of setting potatoes is probably the most adapted to those sorts of soil and situation in which the moisture is apt to be too readily dissipated, as by preserving a level surface it may be more fully preserved in the interstices of such porous soils. As the whole of the surface is in this way covered with dung, it is obvious, however, that a considerably larger portion of manure will be necessary, than where it is deposited in the drills only; it must of course be an improper mode in situations where that article is not easily procured.

These are the principal modes of planting that are employed where the plough is had recourse to; but where labour is cheap, crops of this sort are frequently set by the spade. After the lands have been once well dug over from the state of sward, it is frequently a practice to form a trench across the end of the ridge to the width of about three feet, and from ten to fifteen inches in depth, according to the staple of the land. After this another trench of the same dimensions is made on the side of the former, the surface materials, to the depth of six or seven inches, being thrown into the bottom of the preceding trench upon which the proper supply of manure is laid, and the potatoe sets put in at the distance of eight or ten inches from each other, after which the necessary quantity of earth is raised from the bottom of this trench to cover the sets in the first, and bring it to its proper level.



There is still another mode of planting the potatoe by the spade ; which is that of forming the ground into beds of about six or seven feet in width, according as the land may abound or be deficient in moisture, three or four feet on each side being left to be dug for trenches. The surface of the bed is then to be dug over, and a suitable proportion of manure applied equally over it, the sets are then planted upon it at similar distances to these just mentioned, and covered by means of the mould dug from the side trenches, to the depth of three or four inches. This is generally termed the *lazy-bed* method of planting.

In whatever method potatoe crops are put into the earth, experience shews that it is necessary that care be taken not to plant the sets to too great a depth, as the potatoe has a constant tendency to rise towards the surface ; four or five inches is mostly sufficient in all the drier sorts of soil, and in those of the more moist and heavy nature less may be proper. There is another circumstance that deserves great attention in the planting of this most useful vegetable ; which is that of the sets, of whatever kind they may be, being deposited in or covered by such mould as is in a fine state of mellowness and pulverisation : as, where the earth by which they are surrounded is in a lumpy and unbroken condition, the crops are never so fine or productive.

*After-culture.*—The proper management of the potatoe plant, after it begins to appear above the ground, is a point of great importance in its culture, as it is only by proper attention in this respect that full and abundant crops can be produced. As it has been already seen that the roots of this sort of plant rise towards the surface while they are in a state of growth and forming their knobby bulbs under the ground, it must be obviously of great advantage to have the mould in a loose mellow condition frequently applied to them, as by such means the branching out of the stringy root-shoots or wires is not only greatly promoted, but the distension of the bulbs more perfectly secured, as well as the diligence of the cultivator fully repaid by the increase of produce. In order to effect these purposes, it is the general practice in the best-cultivated potatoe districts to have recourse occasionally during almost the whole growth of the crop, to such means as pulverise, clean, and bring up the fine mould thus provided to the roots of the plants. These are the harrow, the shim, the hand, the horse-hoe, and the double mould-boarded plough ; by the former, the surface mould is rendered fine and powdery, while the latter is beneficial in bringing it up to the rows of the plants. In performing these operations, it is the practice of a cultivator who has had much experience in raising potatoe crops, to harrow the land over when the growths from the sets under the surface are advanced about an inch ; which is only to be ascertained by inspection, as the germination of the sets varies considerably according to the circumstances under which it takes place. The above period is supposed the most proper, from the more advanced growth of the weeds rendering their extirpation more complete, as well as from there being danger of injuring the young shoots by breaking them off when delayed much longer. This process is conveniently performed by a small folding-harrow invented by the writer, which is drawn along the intervals by a single horse, in



which operation it applies mould to the opposite sides of two contiguous rows, destroys the weeds, and pulverises the soil, without the inconvenience of levelling the ridges, which would not only eradicate and break off many of the roots and shoots, but prevent the advantage of their being kept dry. After this, when the potatoes are wholly up, the earth and weeds are to be removed from them by going as close as possible with an ebb furrow, and laid into the middle of the intervals by a small plough with a very narrow earth-board. This is to be performed exactly under the above circumstances; as, when done earlier, there may be inconvenience from those plants that are not fully up being destroyed, and, when delayed much longer, there will not be an equal degree of benefit derived from the operation. It is likewise recommended that, in a few days after the first hoeing, the same implement be passed in the same track to a greater depth. By thus stirring the earth in the intervals that had been trampled down by weeders or other means, it is rendered free, and the weeds that had been removed completely covered; and after the weeds, thus covered up in the intervals, are fully decayed and converted into new vegetable food, the earth is returned to the plants with a double-earth-boarded plough, by passing twice in the same track, and turning a slight furrow to each side, the first being made down hill where the field is uneven, a person following the plough to remove the earth from such plants as may have been covered in the rows by the process, as when left in that manner, their growth is either wholly prevented or very much restricted. And in places where the plants are left without having the mould applied round them, it is to be brought into contact with them by means of the hand-hoe.

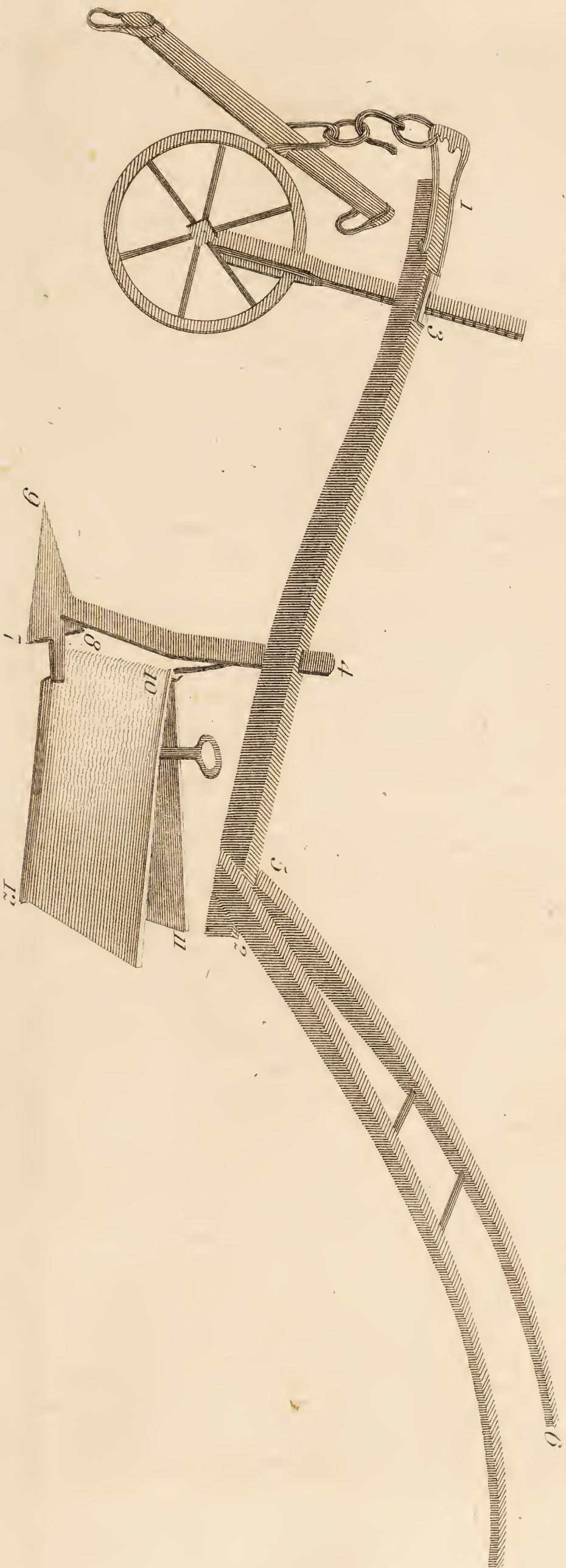
After the plants have advanced to the height of about six inches, the earth is again laid up to them still higher by means of the double-earth-boarded plough, passing twice in the lines of the former earthings, but still considerably deeper than before. In this way the hoeing of the crop is completed. But Mr. Pittman of Essex uses a shim as represented in the annexed plate, for keeping the land clean, &c., which is found to answer well.

By this method of constantly keeping fresh mould applied to the stems of the plants during the period of their growth, the produce has been found to be greatly increased, as it affords a facility to the wires for extending themselves in the loose earth thus laid up, as well as contributes to the perfect growth of the plants. It has been ascertained by different trials instituted for the purpose, that each separate hoeing or earthing up of the plants is useful in promoting a fresh set of runners, and that the potatoes are produced in tiers, according as the different hoeings have been performed; and it has also been found, that where the second and third earthings have not been attended to, the produce has been considerably diminished.

In Lancashire the potatoe crops are mostly kept free from weeds by means of the plough, by turning the earth in the intervals of the rows towards the young plants as soon as they present themselves above the surface of the ground, and in a short time afterwards by turning it back again from each side of them; and occasionally, when the land is very foul, by passing a small triangular harrow be-



*Mr. Lottman's Potatoes Machine.*









tween each of the rows. After the weeds have been removed in this way, the mould is again applied to the plants in the same manner as before, or by means of a double-mould-boarded plough. In this way the crop is rendered clean, and the fine reduced mould well laid up to the stems of the plants.

It is, however, the custom in some districts, where the planting of this useful root is performed on the plain surface without ridges, to depend upon repeated harrowing during the early growth of the crop, for keeping the lands free from weeds as well as for earthing up the plants; but it is evident, that by this method the ground, especially when inclined to be moist, is not only rendered too flat, but little assistance afforded from the small portion of mould that can be brought to the root stems of the plants. Besides, these operations can only be continued for a short time during the early growth of the crop. As it is attended with less expense, it may, however, be practised where the soil is light, thin, and liable to become too dry. But, in general, the more perfect and the longer the stirring of the ground between the rows can be continued, provided the implement does not press too deep in the latter ones, the more vigorous and abundant the crops will be.

The expense of cultivating crops of this root, though it will vary much according to the nature and condition of the soil, the method of planting, and various other circumstances, yet, from the preparation and labour necessary in bringing the ground into a suitable state for the reception of the seed, and in putting it in, it must constantly be high. It may in general be stated to be from about five or six to eight or nine pounds the acre, according to the differences of the land, and the difficulty of obtaining labourers.

*Curl*.—Besides the injury that may arise to crops of this sort from other causes, they are frequently liable to be much hurt by the *curl*; a disease in which the leaves of the plants are, as it were, shrivelled or curled up, and the healthy appearance and vigour of the crop greatly impaired. The reason of this pernicious vegetable affection appears not yet fully investigated, as it has been ascribed to many different causes by writers on husbandry. Most of the early authors considered it in general as originating from distempered seed, which caused it to appear in the crops wherever it was made use of. But in an interesting paper in the second volume of Communications to the Board of Agriculture, it is suggested as proceeding from imperfect culture, or such circumstances as have a tendency to lessen and impair the vigor of the growth of the plants; as the improper nature of the soil, or the want of sufficient preparation of the land on which the crops are grown. It has likewise been supposed to owe its origin to the continued propagation of potatoes by subterraneous buds, or root-wires, instead of seed, as by such means they acquire hereditary disease; as happens in gardening, in the case of canker, to such apple-trees as have been a great length of time propagated by grafting the scions. In opposition to this, it has, however, been maintained by some cultivators, that they have found the curl to prevail in the potatoe plants in such crops as had been raised from seed of the second year. By others it has also been asserted that insects attacking the



leaves may be the cause of the curl; and still others, that the potatoe roots, the leaves of which are attacked with the curl, remain hard and less dissoluble in the soil.

And it has lately been contended, that this disease in potatoe crops proceeds from insects beneath the ground destroying the nutritive part of the sets after they are deposited in the soil; as it was found that from a potatoe planted in a field as seed, there proceeded four stems, two of which were weak and delicate, having their leaves attacked with this disease, while the other two were in a highly vigorous state, and their leaves fresh and free from the curl. On the root being taken up, it was discovered, that all the part from which the curl-leaved stems proceeded was excavated, the substance being wholly consumed by insects. And on more frequently examining such roots as had their leaves affected, it has constantly been found that they have been destroyed by insects either of the snail, centipede, or beetle kind. Sometimes it is, indeed, supposed, that the disease may be caused by the leaves only becoming the prey of numerous minute animalculæ, but that the general cause is in the seed itself being consumed. On this account it is, therefore, that the disease abounds more in potatoe crops in the rich soils in the vicinity of cities, and in that of well-manured gardens; as in such, insects are the most predominant.

But though many of these different causes may operate in producing a tendency to the production of the curl in potatoe crops, they do not any of them seem fully sufficient to account for the disease in a perfectly satisfactory manner. Further investigation into the nature of the disease is still wanting, in order fully to elucidate its cause.

But from whatever cause this vegetable malady may take its origin, no effectual remedy seems yet to have been discovered, but that of a frequent change of seed, and having recourse to such as is brought from a distance, and from such districts as are later, and have soils different from that in which they are to be planted.

The produce of this sort of crop is shown to have attained the full size, and to be in a proper state for being taken up, by the leaves beginning to wither and fall off, and the stems to decay; after such appearances, they should, therefore, as soon as possible, be removed from the ground, in order that they may be secure from the danger of frost, which is sometimes apt to take place about the period when the late planted crops become ripe. About the latter end of September, or beginning of October, is the season in which the general crop is mostly taken up; but the garden and other early crops may be taken up at any time, so as to suit the particular views and convenience of the cultivator, after the stems have attained their complete growth, which is known in most cases by the production of blossom.

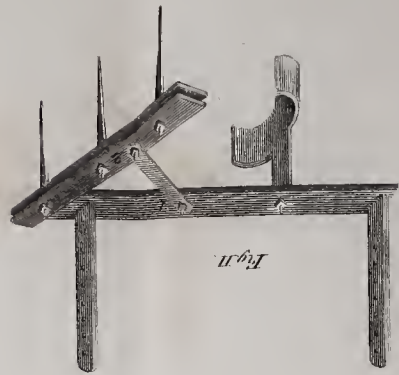
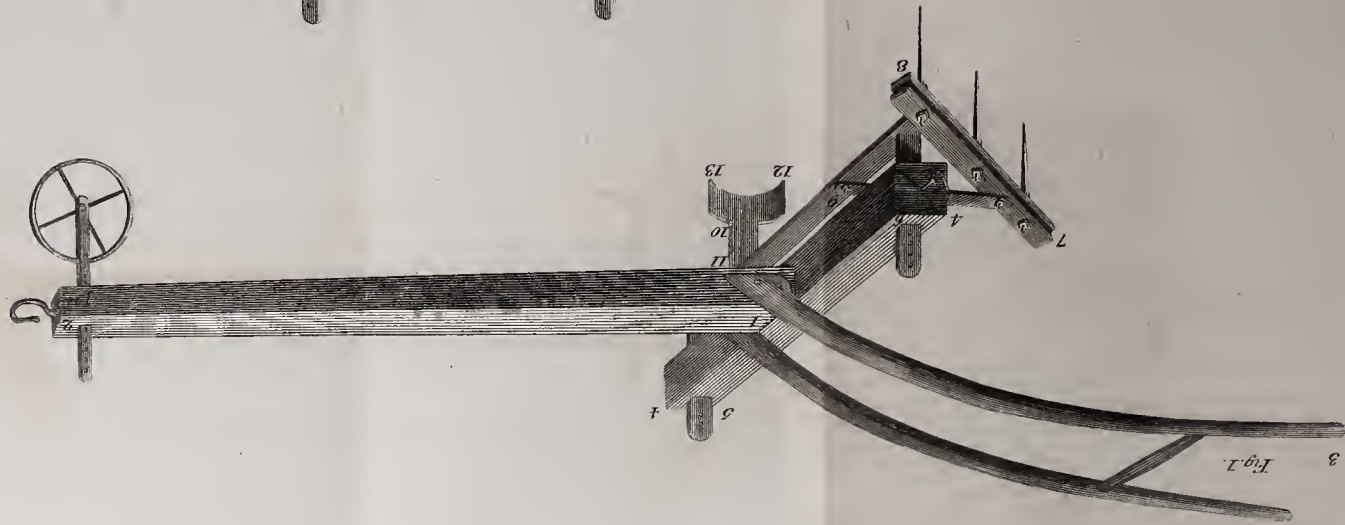
The manner of performing this business is different, according to the extent of the crop, and the mode in which it has been planted. In the garden, and where the space of ground occupied by it is but small, digging the potatoes out by means of a broad three-pronged fork is probably the best practice; as in this way the ground may,







POTATOE HARRROW.





at the time the potatoes are taken up, be dug over, and left in an even and regular state: but where the crop is of considerable extent, and the land not of so light and mellow a nature, but planted in drills for the use of the horse-hoe, the plough may be the most æconomical, as the earth seldom digs well.

For this purpose, it will only, however, be necessary to make use of a light plough without any coulter, turning up the earth of the rows by the share; as by that means the potatoes are less in danger of being injured. In this method, in some cases, it is the custom to set the share against the rows to a good depth, and at once turn them up; while in others it is the ordinary practice first to turn a furrow from each side of the drills, and afterwards to plough up the middle part, in which most of the potatoes are lodged. And in some other cases, after the side furrows have been removed, it is usual to turn over the part that principally contains the potatoes by hand labour with a three-pronged fork.

In which ever way the crop is taken up, the haulm or stems should first be cut off close by the surface of the ground, or pulled up and removed from the land. Where the crop is taken up by hand-labour, one person will generally be sufficient for picking up the potatoes; but in taking them up by means of the plough, the number must be increased according to the circumstances of the crop, always being sufficient to keep up the plough, otherwise there will be great loss in the æconomy of time from the team occasionally remaining unemployed. Some likewise recommend the land to be once or twice harrowed over afterwards, in order to bring such potatoes as may have escaped the pickers to the surface. The annexed plate contains the representation of a harrow contrived by Mr. Young, for the purpose of preventing the great labour and expense of breaking the furrow slices in taking up crops of this sort by the plough: it is worked by a man and horse. The curved iron slides against the unploughed land, at the bottom of the open furrow, and thereby keeps the teeth diagonally placed, to avoid driving the earth in heaps in their work. In friable soils three teeth may be employed, but in stiffer ones only two. It is a tool that performs its work well, and which has saved in his practice from 17s. to 20s. an acre.

*Ft. In.*

The dimensions in <i>Fig. 1.</i> are from	1	to	2	—	5	8
	1	to	3	—	4	6
	4	to	5	—	2	6
	4	to	5	—	0	5
	4	to	6	—	0	5
	7	to	8	—	1	9
	Plate 9	—	0		3	broad.
	Do.	—	0		0 $\frac{1}{2}$	thick.
	10	to	11	—	0	5 $\frac{1}{2}$
	Do. breadth of the iron	0			3	
	In the curve	—	0		7	
	Breadth of curved iron	—	0		3	
	12	to	13			straight line across.

In accomplishing this work, it is of much advantage to separate



the small and bruised from the middling and large potatoes. It is likewise of consequence to choose as dry a time as possible for the business; as when this sort of crop is taken up wet, it is never found to keep well. After the whole of the crop has been raised from the ground, it should be spread thinly upon a dry floor, and be allowed some days in order that it may become perfectly dry before it is deposited in the situation in which it is to remain during the winter.

The produce in crops of this as well as other kinds must vary much according to the circumstances of soil, cultivation, and season. It has been stated by Mr. Donaldson, to be from five to eight or ten tons, and on the average over the whole kingdom about six tons, to the English statute acre. In Mr. Billingsley's extensive experience in the growing of this vegetable, he appears never to have had a greater produce than about a sack in a perch of ground, or one hundred and sixty sacks on the acre, of the eating kinds of potatoes, but he is aware that a much larger produce may be obtained of those sorts employed in feeding of cattle, though he seems to think them less nutritious. In Yorkshire, according to the Agricultural Report of that district, from three to four hundred bushels of those sorts that are commonly made use of at the table, are considered as a good produce; but those cultivated for cattle purposes mostly yield from fifty to one hundred bushels in addition.

In some cases, in the county of Kent, four bushels are said to have been dug up from a single square rod of ground, which is at the rate of six hundred and forty bushels to the acre; which, at the price of only one shilling the bushel, would afford thirty-two pounds as the value of the produce. Crops do not in general, however, afford by any means so large a profit. Still larger quantities have, indeed, been asserted to have been produced in particular cases in the trials of different cultivators, as from seven hundred to a thousand bushels; but in such instances the land must have been very rich, and peculiarly suitable for the purpose, and the season unusually favourable to the crop.

Many different methods of preservation have been attempted in order to prevent the injurious effects of frost, moisture, and germination, on the potatoe, during the winter and early spring seasons: as by the first it is rendered wholly useless as an article of food; dampness makes it quickly liable to become rotten; and by sprouting its flavour is considerably impaired, consequently it is less proper for the purpose of eating: but no perfectly effectual and at the same time convenient mode seems yet to have been discovered. As by too much humidity and heat the vegetative process may be excited too expeditiously, while on the contrary the destruction of the vital principle may have a tendency to hasten the putrefactive fermentation, the great art of obviating such effects in this as well as other roots, when removed from the earth, would seem to consist in preserving them in such a state of life, and in such situations, as that they may not be liable to receive injury by too high degrees of heat or cold, or by excesses of moisture. This may be accomplished by keeping them perfectly dry, and as much as possible in a medium



degree of temperature, between the extremes of about forty-eight and thirty-two of Fahrenheit's thermometer; in the former of which the process of germination for the most part takes place, and in the latter the destruction of the vitality of the roots by the occurrence of frost. Such a steady temperature, under the constantly varying circumstances of this climate, is not however easily attained, and the roots at the same time preserved in a state of sufficient dryness. It has, notwithstanding, been attempted by burying them in pits below the surface of the ground, by depositing them in vaults and cellars or other similar situations, and by placing them in houses constructed for the purpose.

The first method, though practised in many districts, is seldom completely successful, except where the soil is of a very dry and porous quality, and the inclosing of the potatoes conducted with great care and attention. And, indeed, whatever care may have been bestowed in the storing of them in this manner, there is mostly danger from their becoming too much impregnated with moisture from the surrounding earth, and from the closeness and warmth of such situations disposing them to vegetate too quickly in the early spring months. Where it is employed, the best means of guarding against these effects is, however, to have recourse to pretty thick linings, of such substances as, while they resist the effect of cold, have but little capacity for transmitting heat or absorbing moisture. In this view, all sorts of coarse, woolly, or hairy materials, straw, fine shavings, saw-dust, and many other similar matters, may probably be made use of with advantage. The business of *pieing* potatoes is managed in somewhat a different manner in different districts: in some the ground is excavated or hollowed out to the depth of two, three, or more feet, and the potatoes deposited in the pit, as well as piled up considerably above it, so as to terminate in a sort of point or ridge; in others they are only, however, piled up on the level surface in the same forms; but whichever method is adopted, the custom is mostly to cover them with dry straw, about five or six inches in thickness, and afterwards apply over it a good thick covering of earth, raised from a trench dug out all round the heap, and well beaten together by the back of the spade, over the whole. It is likewise the practice in some instances to perforate the crusts or coverings of these repositories, both on the sides and about the tops, with small holes to the depth of the straw, and at the distances of about two yards from each other, in order to let any noxious effluvia, that may have been extricated, escape, but which are to be well closed as soon as this purpose has been fully accomplished. This would, however, appear to be quite unnecessary where the potatoes have been put together in a perfectly dry state, and the bruised or wounded ones have been carefully separated from the rest; but when the contrary is the case, the fluid discharged from them may have a tendency to bring on or run into fermentation, and thus injure such as come near or in contact with them. It has been recommended, that the situation of these repositories should be such, as that one of the ends may constantly face the north, and that they be always thatched over upon the earthy coat with straw in the man-



ner of corn stacks, as by such means the danger of frost and moisture is more effectually guarded against. In addition to these, where this method is followed, it is also probably useful to have recourse to some of the other materials besides straw for forming the internal coats or coverings for the potatoes. And as much inconvenience as well as risk attends the opening the heaps, it may be advisable not to have them too large, as by attention in this respect the whole may be removed at once, and almost immediately converted to use. But in whatever manner this method may be performed, it seems to be less convenient as well as less secure than that of storing them in deep dry cellars or vaults of other kinds, where they can not only be easily removed as occasion may require, but be more perfectly safe against moisture. In this mode, the same attention will, however, be requisite in the covering of them up in the winter months as in the others. The most perfect practice is perhaps that of having houses constructed of suitable materials expressly for the purpose, as in this way the constant trouble and expense of covering and uncovering may be avoided.

Where the cultivation of this root is carried on to a considerable extent, and the produce kept during the winter and early spring months, it may, therefore, be advisable to have a house constructed for the purpose, somewhat on the principle of the dairy-house, or so as constantly to preserve as much as possible an uniform state of temperature between the extremes that have been mentioned, in which the potatoe is found to remain in a perfectly sound and uninjured condition. For such a building a perfectly dry situation, and which is as little exposed to the sun as possible, should always be chosen. In very dry soils it may be the best method to have it sunk something below the surface of the ground, both for the convenience of preserving and storing the crops; but in such as are more retentive of moisture, it will be better to have it wholly above the level of the surface, in order more fully to guard against the effects of dampness. The outside walls may be of earth, well-wrought clay, or any other dense material; but of whatever substances they may be formed, they should be constructed double, or in such a manner as that some kind of light material, such as sawdust, coarse hair, fern, straw, &c., which has a tendency to resist the action of severe frost, may be lightly stuffed in betwixt them: and the roof after being well boarded over, should be covered with an extremely thick coat of good wheat or rye straw. The door may also be formed double in the same way as the side walls, and be so contrived as, on being opened, to prevent the entrance of the air as much as possible, being always placed in that part of the building that has a southern aspect. By this sort of house, and proper attention to the nature of the materials of which it is formed, it seems not improbable that potatoes may be equally guarded from the danger of intense frost and that degree of heat which is necessary to their germination in the early spring season.

This root, joined with hay, straw, chaff, and other similar matters, has been found useful in many cases, especially in the later winter months, as a food for cows, horses, and other sorts of live-



stock; and with these substances, as well as in combination with other materials, as bean or barley meal and pollard, in the fattening of neat cattle, sheep, and hogs: but as there is considerable trouble and expense in preparing them, it being found that they are much more safe and nutritious for such animals when steamed or boiled, they do not appear to have paid greatly when employed in this way. They have been found to be greatly improved by being steamed in an apparatus for the purpose described in the first part of the work, and still more by being baked in proper ovens, as has been noticed in the same place. The results of numerous trials detailed by different writers in the *Annals of Agriculture* do not shew them to have been in this mode of application worth more in general than from four-pence to five-pence the bushel. When given to horses, it may be something more, as there is more difficulty in ascertaining the savings in other articles of fodder that are thereby made, and the advantages that are gained by the animals. It has been stated to be about ten-pence the bushel.

The most general as well as the most useful application of this sort of crop is in that of human food, for which purpose the roots are rendered mealy, nutritious, and fit for undergoing the different processes of digestion, by means of heat, either in water or steam, their acrid juices being in this way converted into mucilage, and probably some portion of that into a fine farinaceous or starchy substance. Experience seems to prove, that where the heat is properly applied through the medium of steam, the potatoes become more mealy and nourishing than where water is made use of for the same purpose. But the differences in the mealiness produced by the boiling of this root is supposed by some to depend more upon the nature of the soil on which it is grown than on any other circumstance. And it has been suggested, that the mealiness of some potatoes that have undergone the operation of boiling, may be sometimes affected by the acidity of the water in which they have been boiled: but it is believed to depend more generally upon the mucilage in some of them being more coagulable than in others, a circumstance the cause of which has not yet been fully investigated.

The washing of this root, where it is employed upon an extensive scale, is frequently a troublesome operation; it may, however, be performed with great ease and convenience, by having a vessel constructed somewhat in the form of a barrel, with small strong narrow laths on the sides, nailed to the solid boards, forming the ends at such distances as may be sufficient for preventing the potatoes or other roots from falling through, and at the same time for admitting the water to pass freely. The potatoes are to be introduced and evacuated by means of a door fixed in one of the sides. The vessel being thus prepared, is to be hung upon a frame of wood over a large square tub containing water, in such a manner as that about one half of it may be immersed; a crooked handle projecting at one of the ends, by quickly turning which, when the potatoes are put in, a large quantity may be expeditiously washed. There should likewise be a contrivance in the frame higher up and nearer the side of the cistern for lifting the barrel from the place in which it turns into, in



order that, by opening the door and turning it round, the washed roots may be easily delivered into a barrow or other vessel placed below and appropriated to their reception. An improved contrivance for effecting this purpose has been noticed in the section on Implements.

*Turnips.*—The introduction of this root into field culture has produced considerable alterations and improvements in the management of arable land, as well as in the feeding and maintaining of different kinds of live stock. It has contributed to lessen the necessity, and remove the loss sustained by the practice of making naked fallows, and at the same time provided an abundant supply of food for the support and fattening of cattle, sheep, and other animals. In this combined view, it may of course be considered as forming the basis of the present improved husbandry on all the more light and friable loamy soils, where its cultivation can be successfully carried on upon an extensive scale; the nature of the plant and that of its culture retaining the land on which it is grown in a perfectly clean condition, and under a state of admirable preparation for various crops, but particularly such as require a fine, mellow, and well-pulverised bed of earth to grow in, as barley, grass-seeds, and many others.

The turnip has a roundish fleshy root, which differs greatly in form and colour according to the circumstances of soil, situation, and culture; but the varieties that have been principally cultivated in the field in different parts of the kingdom are those of the *round* and *long rooted* kinds. The first sort, which varies greatly in colour both in the root and top, has commonly a round flattish root, and is distinguished by cultivators into the *round red* or *purple topped*, the *green topped*, the *white topped*, the *yellow*, the *black* or *red rooted*, the *stone*, and the *Dutch turnip*.

The second sort, instead of having a round shape, and spreading somewhat flatly on the ground, as in the above kind, has a longish cylindrical form, and is known to agricultors under the titles of the *tankard*, the *tap-rooted*, and the *pudding* turnip.

All the varieties of the first kind, from their roots being formed more in the earth than those of the second, which often stand naked above the surface of the ground, are better adapted to the purpose of being cultivated in the field, where there is danger of their being exposed to the severity of frost; but in other cases, as for providing food at an early period for the support of suckling ewes, or the fattening of such sheep as are forward, the latter may be the most advantageous and proper, as they are said to be adopted with success in these intentions in the practice of Hertfordshire.

The cultivators in different districts prefer different varieties of the first sort; but where the situation is open and exposed, those that root deep or stand most in the ground should probably be chosen, especially where they are to be used in the winter season without being previously drawn and preserved, as experience has shown that they are the most secure from the danger of frost. The green topped and white topped are generally esteemed more sweet and nutritious than the red topped, which possesses a degree of bitterness, and is



apt soon to become stringy. The white topped, on the better kinds of soil, is perhaps the most proper and advantageous; as, while it has the property of being hardy, it grows to a large size. This and one of the stone or small hard sort are the most commonly cultivated, and held in the highest estimation in some of the best turnip districts in the northern parts of the kingdom. The latter is supposed by some Northumberland cultivators to stand the severity of the winter season much better than most of the other sorts; but that the produce on the acre is considerably less. And by others it is believed to bulb quicker, have a greater specific gravity, a finer grain, a thinner skin, and to be smoother in the crown of the bulb, consequently less liable to injury from wetness and severe frost. And that though it may not grow to quite so large a size, that defect may be obviated by leaving the plants a little thicker on the ground at the time of setting them out by the hoe. The common white turnip is, however, much cultivated in this as well as most of the southern districts where the turnip husbandry prevails. The green topped turnips have been much recommended by others, both on account of the qualities just noticed, and their being of a large growth, and continuing long in a state fit for use. Mr. Young advises the sowing of the great round Norfolk white turnip, which lies above ground, and adheres to it merely by a tap-root. It grows to a larger size than any of the other sorts, and has the valuable property of being capable of being made use of in the winter season with more ease and facility than those which root quite under the ground. The yellow or straw-coloured turnip is firm and sweet-tasted, but has not yet been so much cultivated as the other varieties, so that its properties are not so perfectly known. The red sort was formerly much in esteem by farmers, but has now mostly given way to other sorts: and the black rooted is very rarely cultivated. The early Dutch is but seldom grown, except in the garden. Where an early crop is required, it might, however, probably be employed with advantage.

The soils that are most adapted to the turnip husbandry are those of the light loamy or deep medium sandy kinds; but it may be practised on those of a thin, gravelly, or chalky nature, and even on loamy clays, in some cases when not too retentive of moisture, with advantage, provided proper attention be paid in the preparation and manuring of such lands. It is evident, indeed, from the successful culture of this useful root upon lands that differ greatly in their qualities, that it admits of more latitude in regard to soil than many other plants, though the opinion seems to have been too general among farmers, that it is only capable of being introduced with benefit on such as are of a very light and friable texture. This has probably had considerable influence in preventing the cultivation of the turnip root from becoming so general, as from its great utility and importance it ought to have been at this period.

But though the turnip may be grown to advantage on soils that vary in a considerable degree in respect to their natural friability and composition, it is constantly necessary to the healthy vegetation and success of the crop, that at least the more superficial parts of



the land, or the bed in which the seed is to be deposited, be brought into as fine a state of reduction or pulverisation as possible; as more is found from experience to depend upon this being effectually performed, than even on the richness of the soil. This is useful in different ways: as, by its promoting the growth of the small seed weeds, they are capable of being more perfectly eradicated, and the young turnip plants of course less endangered by them; while at the same time, a more fine and mellow bed is provided for the reception of the seed, and its vegetation rendered more quick and vigorous in consequence of the more equal diffusion of moisture that must thus take place. In order fully to effect these objects, it is the practice in those districts where the turnip husbandry is carried on in the most complete and successful manner, when the seed is put in on a fallow, to have recourse to four, and frequently five ploughings, having the cloddy parts of the land well broken down in the intervals, by harrowing in different directions and the occasional use of the roller, as by these means almost every particle of the soil becomes exposed to the influence of the atmosphere, and is perfectly aerated and saturated with moisture. The first earth being given towards the close of the year in a shallow manner, so as merely to skim off the rough surface, it may then remain in this situation till about March, when it should be well reduced by harrowing and cross-ploughed to the full depth. If weedy, it is to be again broken down by the harrow in the course of about a fortnight; but, when clean, it is better to remain in its rough state. It may then be left in this condition till about the middle of May, when it should have another ploughing to the full depth; and, when the season is dry, and the soil of the more stiff kind, immediately harrowed, but where it is light this may be deferred for a week or more. These repeated operations, when well performed, generally bring the land into a perfectly fine and clean condition; but if that be not the case, more must be had recourse to. Other cultivators, however, advise the first ploughing to be to the full depth, and that the after-ploughings and harrowings be continued to the middle of June. These must, however, in general be regulated by the nature of the soil, the circumstances of the season, and the convenience of the agricultor. But when the seed is put in after grain, early peas, tare, or other similar crops, the preparation is seldom extended to so many ploughings. In some districts two ploughings and harrowings, the stubble and weeds being at each operation brought together and consumed on the land, are found sufficient with the seed earth. In others, where turnip crops are made to succeed clover or grass seeds, it is the practice to pasture the land in the spring with sheep to so late a period as only to admit of ploughing two or three times. But in many cases, after the surface of coarse pasture and other old grass lands have been reduced by means of paring and burning, good crops of this root may be grown on one earth, or by once ploughing over the land, the ashes being previously spread on the surface in as equal a manner as possible. The ploughing in these cases should be performed to only a slight depth, in order that the crop may derive the fullest advantage from the action of the fire and



the saline principles of the manure on the soil. The Norfolk heavy drill roller is very effective in these cases when passed over the land before and immediately after the sowing of the seed.

In regard to the application of manure for turnip crops, in the first methods of preparing the land, and where it is of the calcareous kind, as lime, marl, or other similar substances, it may be the best practice to apply it after the second or third ploughings, in the first kind, in the proportion of from one and a half to about three chaldrons\*; and in that of the latter, from eight to ten or fifteen ordinary cart-loads, according to the circumstances and nature of the land; as in this way such matters may become the most perfectly blended and incorporated with the mould of the soil. Lime is successfully made use for this crop in Yorkshire, and most other districts where it can be procured. And the use of marl has been attended with equal benefit in the county of Norfolk in England, and Angus in Scotland. The former would seem to be the most proper on such sorts of land as are inclined to be in some measure stiff and adhesive.

When dung can be procured, the experience of different cultivators of the turnip, however, shows that it is the most suited to the growth of the root. For such soils as possess a sufficient degree of lightness, and are in a fine mellow condition, that which is become considerably reduced by fermentation, or in a more rotten and short state, may be the most proper, as it can be the most intimately incorporated with them; but where they have greater stiffness and cohesion, the longer kinds may be more beneficial, as they will not only tend to preserve such lands in a more open and porous situation, but, by their gradual decay in the earth, render them more mellow. Some, however, think it the most proper when it is neither in a very short nor very long state, but in a medium condition between such extremes. Composts consisting of dung and different sorts of materials, as maiden earth, marl, and the mortary rubbish from old walls, in the proportions of one-fifth, well mixed, by having the dung laid over them in the winter, and afterwards blended together more intimately by turning before they are made use of, have also been employed with success. The dust of malt, or what is frequently termed combs, is likewise another substance that the same writer has recommended as an useful application in the way of manure in the culture of turnip crops. And the dung of rabbits, pigeons, and poultry, chopped rags, rape cake, river weeds, and other similar matters, may frequently be employed.

Dung, when employed as manure for this sort of crop, should vary in some measure in the manner of its application, according to the nature of the land and the mode in which the root is cultivated: in general, however, it ought to be deposited in the soil as nearly as possible to the period at which the seed is sown; as in this method, in consequence of the new fermentation that must take place in the soil, the crop may receive the greatest benefit from it. Where the

\* Thirty-two bushels.



seed is to be sown in the broadcast method, it may, therefore, be spread equally over the land, and turned in with the seed furrow; though some advise it to be lightly turned in by the ploughing that precedes the seed earth, and to be well incorporated with the soil by harrowing just before that earth is given. The former appears, however, to be the better practice when the dung is in a sufficiently reduced state, as the plants will have the more full advantage of it. The quantity that is necessary must depend upon the different circumstances of the soil and the richness of the dung; but less than ten or twelve good three-horse-cart loads to the acre can seldom be employed with advantage. If a compost manure be made use of, the proportion should probably be much larger. In Norfolk, according to Mr. Kent, they employ ten cart-loads; but in other districts twelve are made use of, and in others again it varies from six to ten; each containing about thirty bushels.

Where the crop is sown in the drill manner, as it is confined to the middle of the ridges, and does not occupy the whole surface of the land, a somewhat less quantity may be sufficient. A liberal allowance should, however, always be made, as the safety and advantage of the crop depends much upon the rapidity and vigour with which the young plants are pushed forward by such means. When the lands have, however, been well manured for the preceding crop, the turnip crop may frequently be put in without the use of any manure. In whatever method the dung is made use of, it should constantly be spread out evenly, and turned into the soil with as much expedition as possible; as where this is neglected much loss must be sustained by evaporation, especially when the season proves hot and droughty.

When malt-dust or combs is had recourse to, the quantity that is commonly applied is about twenty sacks, of three heaped bushels each, to the acre. The dung of birds in its dry and reduced state, and other substances that have a powdery form, when used for this sort of crop, are mostly laid on in the proportion of from about twenty to thirty bushels to the acre. In applying such manures, as they require only to be put into the soil to a slight depth, harrowing in many cases may be sufficient for the purpose; which should be done just before the seed is sown, care being taken to have them first dispersed in an equal manner over the land.

Rape cake, when brought into a powdery form by mills constructed for the purpose, is stated to have been used in Norfolk by Mr. Styleman, an intelligent cultivator, with much success, in the proportion of a quarter of a ton to the acre; the powder being placed over the seed in the drills by means of Mr. Cooke's drill machine, merely by substituting proper cups and funnels. In Mr. Cooke's practice the rape cake dust is drilled at the same time with the turnip seed from the same machine. This has been a common manure in Norfolk, used by being sown over the land in a coarse powder five or six weeks before the turnip seed is put in; but in Mr. Cooke's management, by having it ground into a perfect powder, it is not found necessary to be applied before hand. And



In this way a ton is sufficient for six acres instead of three. This method may also be adopted with various other sorts of manures, such as bone dust, coal and wood ashes, soot dried, and powdered pigeons' dung, night-soil in powder, and many other similar materials. The soot will, however, require some other substance to be blended with it, in order that it may be delivered more evenly. These are cheap methods of applying manures for these crops, and which have the effect of promoting the quick growth of the young plants, which is of much advantage in preserving the turnips from the fly. When river weeds, which have been tried with success in the same county by Mr. Coke and Mr. Branthwaite, are made use of, they are laid on the ground in their wet state immediately after being removed from the water, and as soon as possible turned in by a light furrow. This substance, from the danger of the vegetation of the seeds, can probably only be used with propriety on such soils as are of a very dry quality.

There is still another method of providing and applying manure for this crop, practised in some districts; which is that of folding sheep on the land after the first ploughing of it up, until the seed earth is given. As the treading of the animals may often be apt to render the land so hard and compact as to be afterwards reduced to the proper state of pulverisation with difficulty, it may be the best practise in such cases only to use the fold in dry weather, always ploughing the ground lightly over as soon as possible after the sheep are removed.

*Quantity of Seed.*—It is difficult to ascertain the proportion of seed that may be requisite in different cases, as much must depend on the nature of the soil, the period of sowing, and the methods and circumstances under which it is put into the ground. In Norfolk, where this sort of husbandry is carried to a considerable extent in the broadcast method, it is generally from about one pound to a pound and a half; while on the sandy lands in Suffolk, and those of the lighter kind in Yorkshire, a pound or pint is found to be sufficient. But on the turnip soils in Middlesex nearly two pounds are employed. It is always, however, a good practice in sowing turnips not to be too sparing in the use of seed, as the unnecessary plants may be easily thinned out at the time of first hoeing over the crop. The calcareous or chalky soils, in general, require the largest proportions of seed. But in cultivating the root in the drill method as the seed is delivered with more correctness, and the whole of the ground is not to be occupied by plants, some saving may be made in the quantity of seed made use of.

*Time and Methods of Sowing.*—The periods of putting crops of this nature into the ground must be principally regulated by the intentions of the cultivator in regard to the disposal of the produce. For the general more early consumption of the root, the most proper season for performing this operation may be about the beginning of June; but when it is intended that the crop should serve as food for animals in the early spring months, it is a better practice to delay the sowing till towards the end of it or beginning of July. When



the root is, however, cultivated upon an extensive scale, it may be advantageous to vary the times of putting the seed into the ground more considerably ; as by such means the plants not only come more in succession to the hoe, but likewise for the purposes of consumption.

In some districts, as those where the practice of lamb-suckling is carried on, very early crops are occasionally required ; in which cases the seed is generally put into the ground as early as possible in the month of May ; such land as is in a fine state of tilth, and perfectly clean from weeds, being chosen for the purpose.

There are different methods practised of putting this sort of crop into the soil in different districts : in most of the southern counties it is the more general practice to sow turnips in the broadcast manner on the level surface ; while in the northern parts of the island, where this sort of husbandry has been considerably improved, it is the more usual method to employ the drill machine, depositing the seed in rows, either on ridges formed by one bout of the plough, or on the level surface ; at the distances of from twenty-four to thirty inches in the ridge method, according to the circumstances of the soil and the intentions of the cultivator, and from ten to twelve or thirteen when on the plain surface.

It is probable that both these methods may be had recourse to with advantage under different circumstances of the land. On the very light, deep, sandy, or gravelly soils, that are apt to part with their moisture quickly, and of course become too dry and parched for the healthy growth of the turnip plant, it may be the most successful practice to put the seed in in the broadcast method on the level surface, as by such means the necessary proportion of moisture may be better preserved for the supply of the crop. But where the soils are of a rather more heavy quality, and not so liable to part with their moisture, the ridged drill method, by the pulverisation which it affords, as well as its tendency to preserve the plants from being injured by the stagnation of too much moisture about their roots, may be the most proper and useful. In this mode of cultivating turnip crops, the hoeing and cleaning of the rows can also be more easily performed, and in a more perfect manner, women or children being capable of being employed in the business ; while the weeds in the intervals are capable of being eradicated, and the mould laid up to the plants by the plough. The only objections to the raised drill method that appear to have much weight are, that from the root being more elevated and exposed, it is not so capable of standing the severity of the winter ; and that larger spaces are allowed than are necessary for the roots to attain a sufficient size, consequently that the quantity of produce will not be so great. It would seem probable, however, that from the pasture of the plants being greatly enlarged, and the crops thereby rendered more healthy and vigorous, the amount of produce must be rather increased than lessened. It has also been contended, that in the raised method there is a difficulty of reducing the land to a level state again ; and that the ground in the intervals becomes unproductive from not having



the advantage of manure: it is obvious, however, that by making the ridges in a proper manner, according to the nature of the land, these inconveniences may easily be avoided.

On dry level grounds it is advised in this view to have the drills in the diagonal direction over the field; and where the ridges are high, directly across them, the plough being drawn down the furrows to discharge the water.

It would seem from the success that has attended the putting in of this sort of crop by the drill in different districts, and the greater ease and cheapness with which the after-culture of the crop can be performed, that it is in general the most advantageous method; but that at the same time it may often be necessary to vary the nature of the ridges and the distance of the rows according to the quality and circumstances of the soil.

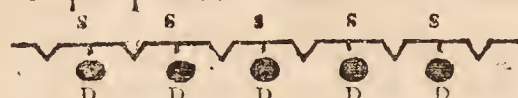
In cases where the broadcast method of sowing turnip seed is practised, it is of considerable importance that the surface of the land be rendered as fine and even as possible before the sowing is performed, and that the seed be delivered or dispersed over it in a perfectly equal manner, and as soon as possible after it has been ploughed up; as upon these operations and circumstances being properly conducted and attended to, the success of the crop in a great measure depends. The latter can seldom be executed by the hand in a proper manner by persons who have not been in the habit of sowing the smaller kinds of seeds: but a sort of box, or a machine constructed for the purpose, is often made use of by those who have not been much accustomed to the business; and, when proper care is taken to see that the perforations do not become obstructed by two or more seeds being fastened in them, may be extremely advantageous in delivering the seed in an uniform and regular manner. The seed, after it has been distributed over the surface in some of these methods, is mostly covered by means of harrowing; a light short-tined harrow being the most adapted to the purpose, as, from the turnip plant forming its bulb in a great measure above the ground, it should probably not be put in to too great a depth.

In the drill method of putting in the crop, the land, after being prepared in the manner that has been directed, is either formed into ridges by the plough, or the drills are stuck in the level surface, as has been already noticed.

The manner of performing the first operation is by a furrow being first drawn as straight as possible down the field, and in returning another furrow from the other side being laid up against it, by keeping the off-side horse in the first made furrow; a suitable proportion of land being given to the plough for forming a ridge of proper height, somewhat in this way  $\Lambda$ . The work is then to be continued in a similar method throughout the whole field, which when finally accomplished will have the appearance of alternate ridge and furrow, somewhat in this manner  $\Lambda\Lambda\Lambda\Lambda\Lambda\Lambda\Lambda\Lambda$ . A distance, as has been observed above, of from about twenty-seven to thirty inches is preserved between the ridglets, in order to admit of the plough passing between them in the after-culture of the crop, but which in less distances cannot be the case.



After the business has proceeded in this way, the manure is to be placed in the drills; which is the most conveniently effected by employing small carts, and having them to proceed along either every third or every fifth furrow, depositing it in small heaps in them; proper persons with small three-pronged forks being stationed so as to follow and place it in an even and regular manner in the bottoms of the three or five furrows, or those in which the manure is dropped from the carts and those on each side of them. After this has been accomplished, the small ridges before thrown up are split down, the earth from each covering the manure up in the middle, so as to form new ridges in the same manner as before. The tops of these ridges are then to be flattened by some means or other; the most common is a small light roller, that passes along two of them at once. The turnip seed is then put in exactly in the middle of the flattened parts of the ridges, by means of a drill contrived for the purpose, and which is frequently fastened to the flattening roller by a rope six or seven feet in length, and directed behind by a person for the purpose. The business, when finished, appearing in this

way ; S representing the seed, and D

the manure immediately underneath it. Most of the drill barrows are implements that may be attached to the ploughs in the same manner. The rollers and drills are mostly drawn by a single horse, driven by a boy; but the person that regulates the latter may also direct the horse, when it is properly trained and accustomed to the work. Sometimes, instead of the roller, a kind of sled, made of wood or iron, is employed for flattening the surface of the one-bout ridges; but a light roller seems to be the neatest and most convenient implement.

The operations of forming the ridglets and inclosing the manure in them, are generally, in the northern districts, performed by a common light swing-plough; but they may probably be accomplished with greater expedition and regularity by a light double-mould-boarded plough.

For the purpose of putting in the seed, drill machines of both the barrow and other kinds are employed; but those that are attached to the plough or roller, and of course perform the different operations of ploughing and sowing at the same time, are, perhaps, in general to be recommended. Great attention is, however, constantly necessary, to see that the seed be regularly dispersed and deposited in the soil; as, from the smallness of the perforations in the revolving cylinders of most of such machines, the seeds are liable to be obstructed, and the regularity of the sowing thereby prevented.

But where the drills are formed upon the level surface without being raised, which is the practice in some districts, and especially when made at narrow distances, as twelve or thirteen inches, the larger sort of drill machines, which sow a number of rows at a time, may be had recourse to with advantage, as being more expeditious\*.

\* Section on Implements.



In whatever manner the turnip seed may be put into the ground, it should be such as that its germination and early growth may be as expeditious as possible. It has been maintained by some, that the seed, in order to secure these effects in the most certain manner, should be placed in the soil to the depth of three or more inches; and they have contended, that the superiority of the drill method partly arises from the seed being deposited to a greater depth, and growing more rapidly in consequence of having more moisture, so as to become sooner out of danger from the fly or other insects; while others, from the circumstances that have been noticed above, think that it should be covered only in a light manner. As it has been already shewn that air is necessary as well as moisture to the vegetation of seeds when placed in the ground, it would seem probable that the quick vegetation of such crops may be the most effectually secured by only putting them in to a middling depth, and according to the particular nature of the land and state of the season as from an inch and an half to two or more inches, as the soil or season may be inclined to be dry or the contrary. In this way, the inconveniences arising from the seed being too much exsiccated by its exposure near the surface, and from the want of the action of the air on account of its too great depth, may be equally obviated.

*After-culture.*—On this part of turnip husbandry being performed in an effectual manner, and at such periods as are the most suitable for promoting the growth of the young turnip plants and preventing those of the weed kind from injuring them by the obstruction and shade which they produce, much of the success of the crops must in general depend; as, without considerable attention in this respect, the labour and expense that have been employed in preparing the soil and putting in the crops must in a great measure be thrown away, the produce being seldom sufficient to repay the cultivator in an adequate manner. This culture is to be accomplished by means of the hoe. Where the crop has been put into the ground in the broadcast method, the hand-hoe only can be employed; but where the seed is sown in rows by the drill, and a sufficient space of interval allowed, those of the horse kind can be made use of, either alone, or in addition after the plants have been properly thinned out in the hand method. It is usual when the plants have produced four or five leaves, or when they cover a circle of from three to four inches in diameter, which, in kindly seasons, will mostly happen in about a month or six weeks from the time of sowing, to begin these operations. In the first of which, such plants as stand too close must be thinned out to a suitable distance, according to the circumstances of the season, the nature of the soil, the period of sowing, and the use to which the crop is to be applied. When the season is hot and dry, the thinning in the first hoeings should not be to too great a distance; as by keeping the plants pretty close together the moisture of the land may be better preserved, and the crop rendered more secure: but in rich soils, when early sown, and when intended to be consumed by cattle at an early period, more thinning may at first be advantageous. The most usual custom is to leave the plants in the first hoeings at the distance of from six to eight inches from each



other; and some cultivators prefer a still greater distance. In the second hoeing, which should be performed in the course of about a fortnight or three weeks from the first, according as there may be necessity, the plants that are to remain for a crop may be left at the distance of from ten to twelve or fourteen inches in the broadcast practice; and at those of from nine to fifteen, or sometimes more, in the rows where the drill system is employed.

In the second hoeings, the mould between the plants should always be well stirred, in order that it may be perfectly aerated, and any weeds that may have risen be effectually destroyed. The future hoeings of crops of this kind must be regulated by the particular circumstances of the cases; but the mould should never be allowed to become too compact about the roots of the plants, or weeds suffered to interfere with the crops. In the county of Northumberland, where the turnip culture is performed in a very perfect manner, it is the general practice in the drilled crops, as they have so much room laterally, to leave them at not more than eight or nine inches apart in the rows. In performing the operation, the labourers proceed side-ways, pulling the surplus plants and weeds into the hollow intervals between the one-bout ridges, the plants being left perfectly regular in the rows. The work is accomplished with much ease and facility by women or children.

After this, when the turnip plants become perfectly established again in the soil, which is mostly the case in about eight or ten days, the earth is taken from the rows where the turnip plants stand, by a light plough contrived for the purpose, and turned upon the plants and weeds left by the hand hoes in the intervals of the ridges. And when they have recovered themselves from this operation, and are become again in a vigorous condition, or when other circumstances render it necessary, the mould, which was in the former process turned from the turnip rows, is now divided and laid up equally to the different rows by the same implement, or a similar one with a double mould-board. In this way, where the land is clean and free from weeds, the business is completed; but when the contrary is the case, additional hoeings and ploughings must be given according to the state of the land.

It has been observed, that, by having the seed put into the ground at different periods, great advantage may be obtained in the hoeing of the crops; it having been found that, by adopting such a practice, six labourers are capable of accomplishing the work twice over one hundred acres or more, while in the contrary case a much larger number will be required.

It is obvious that the hand-method of hoeing turnip crops, which is the only method that can be employed where the broadcast plan of sowing is pursued, is not only much more troublesome and expensive, but more confined and less beneficial in its effects than that by means of the horse-hoe or plough. In the former mode the expense of the two hand hoeings are generally from six to eight or nine shillings the acre; while in the latter it rarely amounts to more than four or five. Besides, by the use of the horse-hoe or plough in the intervals, the crops are not only kept more clean, but a more



continued and more abundant supply of nourishment provided for the growth of the plants, on account of the repeated full aëration of the mould that must take place.

In Berkshire they have a sort of hoe plough which effectually cleans the intervals of drilled turnips, by going up one interval and down another, being drawn by one horse. It is an extremely light convenient tool. But in whatever way the operation may be performed, or whatever plough or hoe may be made use of, it must be of the greatest advantage to have the mould well loosened near to the plants, especially on the heavier descriptions of turnip soils; and in these, as well as those of the more light kinds, the turnip plants should never be suffered to be annoyed or incumbered by any sort of weeds growing near them.

Turnip crops are exposed to danger from different causes during the early stages of the growth of the plants; but the chief are the attacks of the fly, the slug, and the black caterpillar. The first chiefly prey upon the tender saccharine seed-leaves of the young plants, and its presence is rendered sufficiently evident by its leaving many little brown spots on them, and by eating away their fleshy green parts down to the fibres. They are said to increase both in number and size until the plants are consumed. The ravages of the slug may be easily traced, by observing the edges of the leaves; as it is upon them it first begins to feed, gradually proceeding from one part to another till each of them is more or less consumed, and the whole of the plants in many cases be destroyed. It has been well remarked, that a field of young turnips, when attacked in this way, exhibits some of the leaves as having lost a quarter, others one-half, some three-fourths, and others the whole, the stems only remaining, and in some instances these are also attacked.

The depredations of the black caterpillar principally take place after the crops are in a more advanced state of growth, and the plants have formed considerable tops, and are in what is usually termed *rough leaf*: the green parts of the leaves being eaten through and destroyed, and of course the growth of the plants prevented.

Various means of preventing the young turnip plants from being destroyed by animals of these kinds have been suggested at different times; but hitherto probably without any of them being effectual. It would seem, however, from what has been already advanced, that their safety and preservation depends much both on the land being so enriched by manure, and in such a condition in respect to moisture, as that the germination of the seed and after-growth of the plants may be such as to render them quickly in the state of *rough leaf*. This, as has been seen, may likewise be further promoted, especially in hot and dry seasons, by steeping the seed in some watry or other liquid before depositing it in the soil. In these as well as other views it has been recommended to make use of new feed and such as is one year old together, as in this way the crops, by coming up at different times, may be less in danger of being wholly destroyed; or what is probably a better practice, to steep one-half the seed, after being thus mixed, in water for twenty-



four hours, and then blend the other half with it, sowing the whole in the usual manner. In this management the plants, by rising at many different periods, may have a greater chance of escaping in sufficient quantity for the purpose of a crop. This method is indeed particularly enforced by the observation, that the insects frequently make their attacks suddenly in large numbers, destroying the plants as fast as they rise, and as suddenly disappear, leaving such as come up a few days afterwards untouched.

On the supposition that some other sorts of plants are more agreeable, and consequently more subject to be fed upon by this devouring insect than the turnip, the practice of sowing other sorts of seed with that of the turnip has been lately revived and recommended. In this intention it has been advised to mix and sow radish seed with that of the turnip, in the proportion of about two pounds to the acre. It is evident, however, that this plan must be extremely uncertain, as it cannot be successful except where the two kinds of plants rise exactly at the same time, which from the great difference in the vegetative powers of the two seeds, will probably seldom be the case. If any advantage is to be gained in this way, it must be by employing a plant which is preferred to that of the turnip, and the seed of which is somewhat quicker in its germination and growth; as where this is not the case, the turnips may frequently be destroyed before the other plants be in a state to be fed upon. It has been suggested that the *ruta бага*, or Swedish turnip, may be a more useful substitute in this view than the radish; as by its being steeped and the turnip seed sown dry, the plants would rise well together, and the fly is well known to be so eager in feeding upon it, that it is with difficulty the cultivator can preserve a sufficient plant. In this case it is hinted as a further advantage, that when both sorts of plants remain without sustaining any material injury, the farmer may have the option of cutting out either of them, as he may find the most convenient and beneficial.

As the effects of the slug, which is an animal of the white snail kind, on turnip crops, are often equally, if not more destructive than those of the fly, from its attacking them at a later period, and consuming not only the leaves, but the more solid parts of the plants, it is necessary for the cultivator to guard against them also as much as possible. In this intention various means have been proposed, but probably without any of them being completely successful: from its having been remarked, that these slugs chiefly quit their terrestrial habitations during the night-time, or early in the morning before the sun rises, when the surface of the soil is moist from the dews, it has been advised, by the older as well as the more modern writers on agriculture, to have recourse to rolling in the night with a roller of considerable weight, in order to crush and destroy them before the light or heat of the day induces them to retire into the soil.

The dispersing of different substances, such as vegetable ashes, lime, and soot, in the state of fine powder, over the turnip crops by the hand, may likewise be occasionally employed with advantage



both against the fly and the slug, in the proportion of about ten or fifteen bushels of the first, and twenty of the others : the former by the powers which they possess of destroying such animals, their attracting humidity from the atmosphere, and their furnishing more abundant supplies of nourishment to the young plants ; the last by its rendering the young plants nauseous and unfit to be fed upon, as well as the promoting of the more rapid growth of the plants. The sprinkling of water in which tobacco-leaves have been infused over the plants, from the tail of a cart, has also been suggested as useful on the same principle as soot against the slug ; or, what is probably better, especially where the crop is not extensive, as being found highly successful in garden practice, the mixing of the tobacco-water with soap-suds and urine. The use of this composition is said not only to bring them up from their holes and habitations, by which they quickly die, but to destroy the ova deposited in the soil.

There are still other methods recommended for the purpose of preventing the depredations of this animal, one of which seems equally cheap, convenient, and effectual ; which is, that of sowing barley chaff over the whole of the crop immediately on its first appearance, as by this means the slugs become directly entangled and destroyed. In the way of a palliative, it has likewise been sometimes a practice to turn a flock of sheep upon the turnip lands, keeping them constantly in motion by means of a dog and person to attend them. In this mode the slugs are shaken from the young plants, and destroyed by being trodden into the ground.

Against the ravages of the black caterpillar, which, as has been observed, take place in the more advanced growth of the turnip plant, the use of the tobacco infusion or mixture just mentioned may frequently be serviceable, and even the application of the barley chaff over the crop on the caterpillars first shewing themselves, taking care at the same time to pass a light bush-harrow over it in order to displace the animals from the plants to the ground.

Besides the diseases arising from these causes, and which affect the leaves of the plants, the turnip is subject to disease in its root. This is a large excrescence forming itself below the apple or bulb, which, after becoming in a state of maturity, takes on the putrid fermentation, and sends forth a most offensive smell. It has obtained the title of *anbury*. In several specimens examined by Mr. Marshall, the apples of the turnips were found just forming, as about the size of walnuts in the shell, while the anburies were as large as the egg of a goose, being awkward and irregular in their form, with inferior excrescences, somewhat resembling races of ginger, depending from them. On being cut, their general aspect was that of a hard turnip ; but on being examined with more minuteness by means of a magnifier, veins or string-like vessels were observed dispersed through the pulp : the smell and taste being in some respect similar to that of the common turnip, but without its mildness, having an austere disagreeable flavour, approaching to that of an old stringy turnip. The tops in such as were much af-



fectured, turned yellow and flagged by the heat of the sun, being easily distinguishable in the day time from the healthy plants. The cause of this disease has, perhaps, not yet been fully investigated; but Mr. Marshall seems to suspect it to proceed from the wound or puncture of some sort of grub in the vessels of the tap-root, by which the course of the sap is diverted, and instead of the natural apple or bulb being formed, this excrescence takes place.

On light thin soils, in dry seasons, the mildew is also a disease that is sometimes apt to affect turnip crops, and do great injury to the young plants by restricting their growth. The only remedy in this case is probably that of properly thinning the plants, and stirring the earth well about their roots occasionally, by means of the hoe, in order to provide them more fully with nourishment. Where it occurs in lands of a more retentive quality, advantage may likewise, perhaps, be obtained, by rendering them drier by deepening the ridge furrows, or some other similar method.

The seasons most suitable for turnip crops are those in which the weather is warm, with frequent showers, but little continued rain. In the autumn and winter periods, when frequent changes from frosts to thaws and rain take place, turnips commonly experience great injury, being rendered extremely subject to decay, and become rotten; and even such as withstand such seasons seldom afford a due proportion of nourishment to the stock that may be fed upon them.

Roots, if not prevented, often do considerable mischief to turnip crops in the winter time, by picking holes in the bulbs, admitting the wet, and thereby causing them to decay.

The produce of turnip crops varies greatly according to the season, the nature of the soil, and the method of cultivation that is practised: but a medium crop, where the soil is good and suitable for the purpose, may afford fifteen tons, or something more, on the acre; in many instances, it will, however, be much less. The value of these crops will depend upon various circumstances: as their quality and abundance; the manner in which they are consumed, as on the land or in cribs or stalls; in fattening or rearing different sorts of live stock; and the state of the markets in respect to the sale of such stock. In general it may be from about three to six or seven pounds the acre. It is found by experience that an acre of good turnips will be sufficient to fatten a beast of about forty stone, or eight sheep. In feeding off in the open field, they are found to pay from two shillings and six-pence to four shillings and six-pence the ton, a crop of twenty tons producing in beef or mutton from fifty shillings to four pound ten shillings, besides the dung and urine, which may be equal to fifty shillings more. When consumed by cattle in stalls, they are stated, however, to afford one shilling a ton more than when eaten by them in the field.

In cultivating turnips for seed some attention is necessary, as, where it is collected from such turnips as have been sown three or four years in succession, the roots are apt to be numerous and long, and the necks or parts between the bulbs and leaves coarse and thick: and when taken from such as have been transplanted every



year, these parts are liable to become too fine, and the tap-roots to be diminished in too great a proportion. The most certain method is to procure seed from turnips that are transplanted one year and sown the next; or, if they be transplanted once in three years, it is supposed by some that the stock may be preserved in a proper state. The method of performing this business is to select such turnips as are of the best kinds and of the most perfect forms, from the field crops, and, after cutting their tops off, to transplant them, about the month of November or December, into a piece of ground that has been put into a fine state of preparation by repeated ploughing or digging over, and which should be situated as near the house as possible, in order that the birds may be better kept from it. The seed will, in general, be ready for gathering in the July or August following.

When the seed is become fully ripened, it is in some districts reaped by cutting part of the stems, and afterwards tying them up into sheaves, which, when sufficiently dry, are built into long stacks, and kept through the winter, in order to be threshed out about the periods when it is wanted, as in April or May. But a better practice is to have it immediately thrashed out either upon a cloth on the spot where it grew, or in some convenient place at home. It should then be put into proper bags or vessels, and placed in a perfectly dry situation.

As crops of this sort are subject to much injury and loss in various ways, the quantity of produce must be variable; but it may in general be estimated at not less than from twenty to twenty-four bushels the statute acre. The price of turnip seed being seldom less than seven or eight shillings the bushel on account of the great demand for it, this sort of culture may at first sight appear highly advantageous; but if the exhausting nature of the crop, the loss sustained in that of a grain one, and the quantity of manure that must afterwards be employed, be considered, it is probably only in particular situations of soil and climate that turnip seed can be grown to much advantage.

In the application of turnips to the purposes of feeding and fattening different sorts of live stock, there is much variety in the practices of different districts; but the most economical and advantageous modes of consuming this highly useful root under different circumstances of soil, climate, situation, and animals, have probably not yet been sufficiently investigated or ascertained by cultivators.

Though few experiments appear to have been instituted with a view of determining the particular state in which these roots afford the greatest proportion of nourishment to the animals that feed upon them; it would seem, from their containing a much larger proportion of nutritious saccharine juicy matter while in their fresh or green state before being taken from the ground, than when taken from the land and preserved by being packed up in sheds or other places\*, to be a more economical and beneficial practice, especially

\* This is evident from their losing their firmness, and becoming soft, wrinkled, and flabby, and diminishing considerably in weight.



where the nature and situation of the ground and the state of the season will admit of it, as on the dry soils in most of the southern districts, to consume them under the former than the latter circumstances; but in the more cold exposed situations, as in many districts in the northern parts of the kingdom, and wherever the lands are much inclined to moisture, as the roots may be greatly injured by the frosts, and the animals receive much injury from the coldness of such places, while feeding on them, as well as the lands be much damaged by their treading, it may be better to eat them under the latter. Where the lands are sufficiently dry, in a high state of fertility, and conducted under a judicious system of husbandry, it may often, however, be an advantageous and economical practice to have a partial recourse to both the methods; by having one part of the crop drawn and removed to be eaten in some convenient situation off the land, according to the particular circumstances of the case, and the other consumed in the field where they grow: as by such means a much larger quantity of ground may be benefited and improved, without injury being done to the crops that may be afterwards cultivated on the land. This method of rendering arable grounds proper for the growth of turnip crops seems to have been too much neglected, considering the great advantages that may be derived from it in the feeding and rearing of live stock, as well as in the amelioration of the land.

The nature of the animals by which turnip crops are consumed must obviously introduce differences in the manner of their application. When they are employed in the rearing or fattening of neat cattle, they are generally pulled up and eaten either after being conveyed to some convenient dry piece of ground in the state of grass or stubble, or some place of security contiguous to the straw-yards or feeding-houses; in the latter methods, the turnips being given to the animals in bins or cribs, or placed before them in stalls constructed for the purpose, in which the cattle are tied up. The last is probably the better practice, though not so frequently employed; as there is the least possible waste, at the same time that the dung and urine of the animals are the most effectually preserved. In the first method the fat stock are first admitted, the lean following to eat up what may remain; they are often constantly confined upon the turnips, except when prevented by the severity of the season, in which case the straw-yard is generally made the place of their consumption. The lands to which also turnips are removed in this way of feeding, are, in some districts, those intended to be ploughed up the ensuing year for wheat or other sorts of grain, consequently each field, in its turn, has the advantage of having such crops consumed upon it, which is found more beneficial than feeding them on the land where they grow. The turnips in these cases should not be scattered over the ground in too thick a manner: as, where that is the practice, much loss must be sustained by their being crushed and bruised by the feet of the animals. All these different practices are met with in the county of Norfolk, where great numbers of different breeds of cattle are annually fattened upon turnips.

In most of the turnip districts in the northern parts of the island,

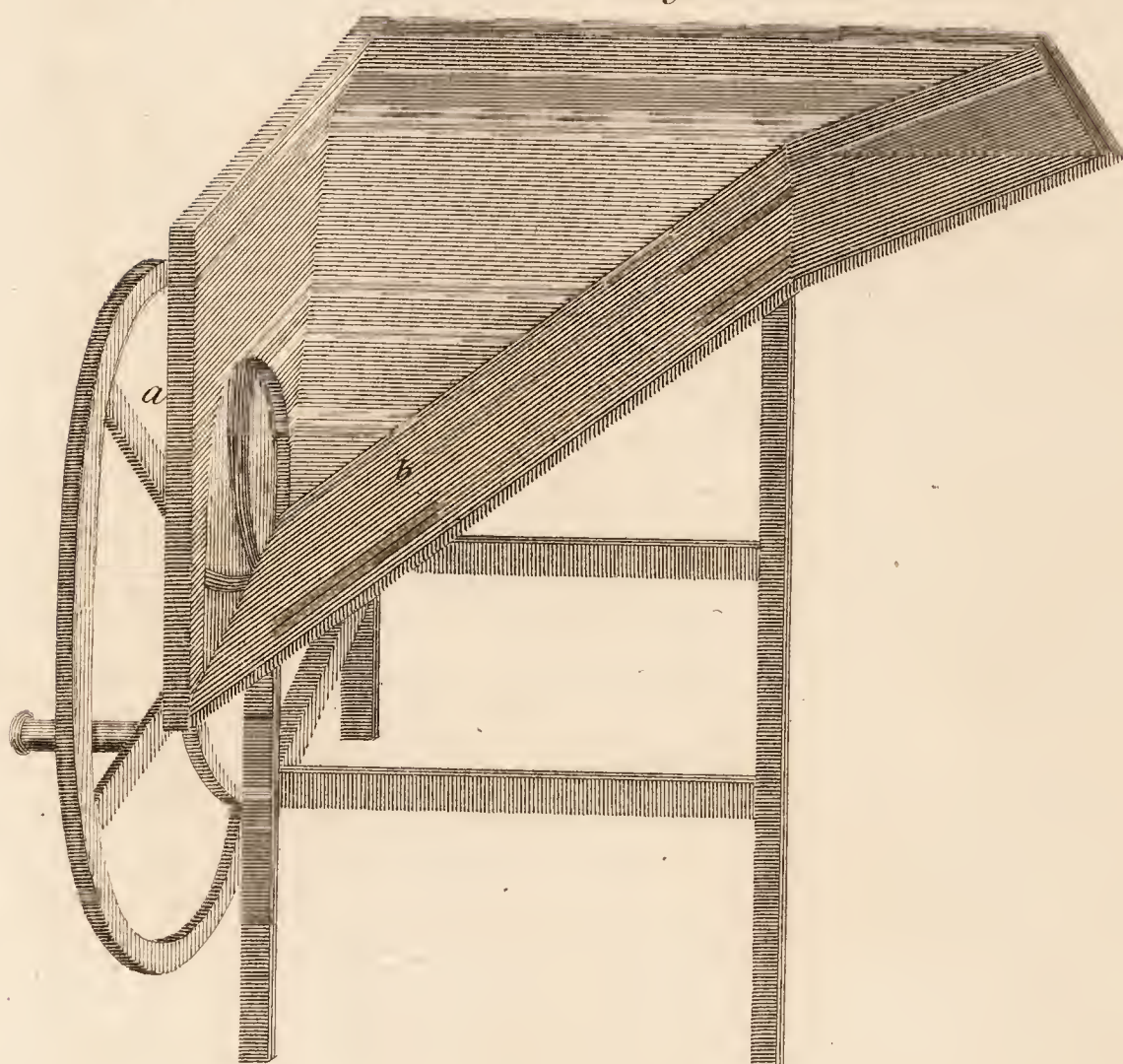






*Turnip Slicer.*

*Fig. 1.*





When converted to the purpose of rearing young stock, they are generally consumed in the straw-yards, when the farmers have the advantage of such conveniencies; but in other cases, in the same manner as above. Near large towns, where milk is a principal object, turnips may likewise often be applied in the way of a rich succulent food for milch cows, but in this mode of using them great care should be taken that all the putrid and decayed leaves or other parts of the turnips be removed, otherwise the milk may be liable to derive an unpleasant flavour from them\*. The offal produced by these means may be made use of for the dry stock, and of course little or no loss be sustained.

Turnips have also been found to be capable of being applied in the feeding of labouring horses with much success; as by their use the usual quantity of corn may be lessened in the proportion of nearly one-half, and the animals not only improve in condition, but perform their business with greater ease, and be less subject to complaints of the bowels than when fed in the ordinary way. In the annexed plate is represented an *improved Turnip Slicer*, which is found very convenient.

The turnips in this machine are cut by means of a knife fixed on the fly-wheel *a*, being brought to it through the inclined trough or box *b*. A square box with a sharp spade is likewise a method by which they may be readily and cheaply cut.

In the consuming of turnips by sheep, which, where the most valuable breeds are introduced, is the most extensive application of such crops, the most general practice, where the lands are light and sufficiently dry, is that of confining them upon a suitable proportion of the crop, by means of nets or hurdles, removing them to fresh portions or *breaks* every eight or ten days, or oftener, according to circumstances; but if the grounds be of the more heavy kind and somewhat retentive of moisture, it is a better and more economical method to have the turnips conveyed off the land to some neighbouring field, as has been already noticed, as by this mode there is not only less injury and waste, by the treading of the turnips into the ground, but the sheep get a more regular supply of fresh food, and the shells, by being left clean, are more completely eaten up by the store cattle that are to follow.

In performing of this business the drills should be contrived that the wheels and horses may pass in the furrows, and by that means prevent poaching.

Where the custom of eating on the ground is employed, it is also sometimes, as when the land is poor, a practice to draw every other ridge of turnips, and remove them from the field to be eaten in another place, while the remainder is consumed upon the land on which they grew.

In folding upon turnips it is mostly the custom to turn the sheep upon them while standing in the field; but, except where the bulbs are much exposed above the surface of the land, it is probably a much

\* Corrected Agricultural Report of the County of Perth, p. 184. It is observed in the same work that where such a taste prevails, it may be completely removed by making use of a very weak solution of nitre in water.



better practice to have them drawn up before the hurdles are fixed or the sheep turned in, as the animals are not only less apt to break and soil the turnips, but feed much better upon them. This is a method of proceeding not unfrequently had recourse to in the county of Norfolk.

It has been suggested by a late writer, that much loss is often sustained in these modes of folding sheep upon turnips, especially where they are cultivated under the broadcast system, and it is the custom to give the sheep large folds or *breaks* at a time, from the occurrence of frost or snow. In such cases he thinks the drill or ridge methods far preferable; it being easy to have sheep-pens, or turnip-trays made and fixed in such a way as to constitute a sort of moveable trough, the bars or trays being set near the side of the rows of turnips, and boards from ten to twelve inches in breadth, having stakes of suitable lengths, according to the depths of the soils, nailed to them, fastened on the sides from which the sheep feed: the narrower the spaces the turnips are included in, the better. As it may be apprehended that the animals may get in among the turnips thus fenced off, it is remarked, that supposing they occupy a regular space of about twelve inches, the troughs may be made little more than a foot in width at the bottom, having a sloping direction upwards. The trays or bars may likewise have an inclination towards the sheep, and hang over the troughs or parts in which the turnips are inclosed, and thus prevent them from getting in. In this way it is supposed the sheep will have their food quite clean, and by setting off at a time only the quantity necessary for a day, they may eat it with more avidity and without the danger of spoiling so much by their excrement.

It has been found in the fattening of sheep with this root, that they make the greatest progress just before the turnips begin to run and form their seed-stems; a circumstance which probably depends partly upon the turnips containing at such periods the largest proportion of saccharine nutritious matter, and partly on the weather becoming more dry and warm. Hence it is a practice in some districts, towards the latter end of March or beginning of April, according to the state of the season, to mow off the shoots or stems that are advanced, with a scythe; as, by this means, from the numerous lateral shoots that are sent forth, a more copious supply of green food is not only afforded, but the roots or bulbs of the turnips preserved longer in a state fit for use.

In folding sheep on turnips, it frequently happens that after frosts or snows the hurdles get loose, and are either thrown down by the animals or the wind; great care, should, therefore, be taken to have them at first well set into the ground, and secured by stakes of sufficient length, with proper *wyths* for tying them together.

The hurdles employed for this purpose are generally of two kinds, either *flatted* or *rodded*: the former being made from small poles of ash, willow, or other tough sorts of wood, by splitting them; and the latter from rods of hazel, or other suitable woods, by wattling them close together with suitable cross pieces like stakes. The *flatted* hurdle, or what in some districts is termed *waddle*, is much preferable to the *close-rodded* or *wattled* kind, as being much more



**Durable.** The first cost of them is, however, considerably greater\*. There is also another sort of material made use of in some districts for this purpose; which is a sort of net work, formed of small cord, called *toiling*. This method is, however, more expensive than that of hurdles, and less convenient; but may save something in carriage, where hurdles are to be brought from a considerable distance.

Where turnips are intended for the feeding of cattle, or other sorts of stock, in the winter and spring months, as they are extremely liable to be destroyed by the sudden alternations of frost and thaw, becoming in many cases quite rotten and unfit for use, it is necessary to preserve them by some means or other during that season. For this purpose many different methods have been attempted, but probably without any of them being completely successful. The only perfectly secure method of protecting them against the effects of intense frost in such seasons, is perhaps that of having them drawn, topped, and piled up with dry straw in houses constructed for the purpose, contiguous to the cattle-sheds, or feeding-stalls. This mode is, however, liable to objection, as being both troublesome and expensive, especially where turnips are cultivated upon an extensive scale. There is, however, another method which has been found very effectual, and which is less expensive, and attended with but little trouble; which is that of stacking them upon the field where they grow, with layers of dry straw betwixt those of the turnips. This is a mode frequently practised in the county of Hertford, where they use one load of straw to about thirty or forty tons of turnips. The manner of performing the business is this: the turnips being drawn during a dry time, and the tops and tap-roots removed, a layer of straw is spread on a dry part of the ground, and a layer of turnips placed upon it to the thickness of eighteen inches or two feet; after this another layer of straw, and then a layer of turnips, proceeding alternately in the same manner till the heap or stack is brought to a ridge or point; when the edges of the different layers of straw are turned up, which serves to prevent the turnips from falling out, and at the same time affords a sort of external covering to the heap, which is completed by being thatched well over the top with long straw. They have also been attempted to be preserved by being formed, without straw, after the tops have been cut off and used as a green food, into what are termed *pies*, in the way that potatoes are sometimes kept, being well thatched over on the outside.

It has likewise been suggested, that the difficulty of getting them up, and the danger they are exposed to during frosty seasons, as well as the inconveniences the cattle experience in feeding upon them from their coldness, may be prevented by piling them up in small stacks, the tops outwards, near to the places where they are intended to be consumed, with a little straw between the different layers, covering them over with wattles or hurdles lined with straw. If this practice was adopted on small portions, it is supposed that much advantage would arise from it to the cattle in frosty weather, besides the turnips

\* The former sort are mostly sold in the neighbourhood of London, at from about 16s. to 18s. a dozen, and the latter at from 10s. to 12s. the dozen. *Toiling* is generally from about 2s. 10d. to 3s. 6d. the rod.



being preserved and prevented from exhausting the land by remaining so long upon it. The same advantage may also, it is believed, be obtained by sinking beds about two feet deep, and of considerable breadth, in the ground where the turnips grow, putting five or six layers of turnips into each, with a little fresh earth between every one of them, and covering the tops over with straw. This method seems, however, only capable of being employed with safety where the soil is of a light porous sandy quality, and of course not retentive of moisture.

There are still other methods that have been recommended for preserving this root. The practice of drawing the turnips, cutting off the tap-roots, and carting them to a piece of pasture ground adjoining the farm-yard, to be set together upright upon their bottoms, as close as possible, has been found successful in some districts. The growth of the tops is, it is observed, in this way but little interrupted, thus consequently affords a full compensation for any waste of bulb that may take place. And it is believed that the quantity of nutritious food is increased. The business is best performed when the weather is dry and windy, as the tops are then less brittle and the roots in the cleanest condition.

Mr. Munnings of Norfolk, preserves these roots against frosts by covering them by a deep furrow, at a dry time towards the end of November. His turnips are drilled on the flat surface, but the practice may be equally or more proper on those raised on ridges.

It seems not improbable but that turnips might be well preserved against severe frosts, at least on a small scale, by the application of straw, fern, or any similar light substance that has the power of resisting its operation, along the rows as they stand in the field, as is frequently practised in the garden culture of different kinds of vegetables.

By these means, it is obvious, turnips may be preserved both as a winter and spring food for different sorts of live stock, even in situations and seasons that are the most exposed and severe. Where sheep husbandry is carried on upon an extensive scale it may indeed frequently be a more advantageous practice to have recourse to this root for the ewes in the spring months, than to consume them during the winter in fattening neat cattle; as in this way they will be better enabled to bring forth and provide for their lambs, which are circumstances of great importance. But in mild seasons, when sheep do not stand in need of them, or are not kept in any great number, it may be the most beneficial method to apply them to the fattening or keeping of store cattle; in the latter of which the animals will be brought into such a state of forwardness, as to be readily completed on grass in the ensuing summer.

*Ruta Baga, or Swedish Turnip.* This is a root of the turnip kind, that has long been known, but only lately introduced into cultivation with much advantage. It has been considered by some as a variety of the yellow turnip, but it differs greatly from it both in its texture and properties. In its top it has something of the appearance of the rape or the cabbage; the bottom, or that part of the root which is above the ground, is covered by a thick green tough cuticle or skin,



and the internal fleshy part is of a dense firm consistence, have a yellowish tinge. It is suspected by some cultivators that there are two varieties of this plant, the one having a *white* and the other a *yellow* root, the latter being considered much the best. This may, however, probably arise from their having been grown in the neighbourhood of plants of the turnip or cole kinds.

The principal inducements to the cultivation of this root are, according to Mr. Young, first, that where the farmer “has the right stock of seed, the root yellow in flesh and rough in coat, it lasts through all frosts, and may be depended on for sheep quite through the month of April, though drawn two months before, and spread on a grass field. 2. That it is an excellent and nourishing food for sheep, and also for any sort of cattle. 3. That it is equal to potatoes, in keeping *stock* swine, a point of very great consequence. 4. That it is, next to carrots, the very best food that can be given to horses. And 5. That it is sown at a season which leaves ample time, in case of a failure, to put in common turnips, or cabbages.”

It may be grown to advantage on most of those soils that are too moist and heavy for the common turnip, but the land should be brought into a tolerable state of pulverisation, and be well impregnated with manure, before the seed is put into the ground, or the plants put upon it. Such a preparation as is fit for turnips answers well in this case: paring and burning is perhaps the best sort of preparation of any for this kind of crop. It is perhaps from the want of this due preparation of the land, and the putting in seed of a bad kind and at too late a period, that cultivators have so frequently failed in obtaining good crops of this valuable root.

*Seed.*—The seed should be constantly collected from such plants as have been transplanted, and which are the most perfect of their kind; as where this is neglected, the cultivator can never be certain of having his plants of the proper sort. The quantity of seed that is made use of where the broadcast method is employed is generally from about two to three pounds the acre, but where the drill plan is pursued a smaller proportion may be sufficient; but as it is mostly found difficult to produce a sufficient plant, it may be advisable never to be too sparing in the article of seed. New seed is constantly to be preferred, and when the season is dry, it may be of utility to have it prepared by steeping.

*Time and method of sowing.*—As this plant is much slower in its vegetation than that of the common turnip, it ought to be put into the ground at an earlier period; by which means it will not only be more forward for the hoe, and more fully established in the soil, but better protected from the attacks of the fly and the heats of the ensuing summer months. It has been the usual practice to sow this crop at the same time with that of the common turnip; but if put in three weeks or a month sooner it will be found more advantageous, as from about the tenth of April to the tenth of May, or perhaps a little later in the northern districts. And it may be useful in many cases to put in a second crop in June; or where the first has been destroyed by the fly, to re-sow the land after being well scuffled over.

Different methods are practised in raising this sort of crop: some-



times instead of sowing the seed over the land in broadcast or drills, it is sown upon beds of good earth; and after the plants are sufficiently advanced, as when they are about the size of small cabbage-plants, they are transplanted into the field, and set out in rows at a distance of eight or nine inches from each other, and a foot or more in the intervals. The business of transplanting should, if possible, be performed when the weather is moist. This may be the best method where such crops are cultivated only upon a small scale; but where they are grown more extensively, the former are to be preferred, as being more expeditious and convenient, as well as more certain of affording a sufficient plant.

And in this mode of sowing, the seed should be put in where the plants are to grow, as they do not answer so well where transplanted even under the most favourable circumstances.

*After-culture.*—In this part of its management, the Swedish turnip, from its growing in a more slow manner than the common one, requires more attention, in order that it may be kept perfectly clean and free from weeds, which, under such circumstances, are extremely apt to rise. This is also of vast advantage in pushing forward the plants to the state of rough leaf. The operations of hoeing are to be performed in a similar manner to those for the common turnip, and repeated as frequently as may be necessary, keeping the mould well broken and laid to the roots of the plants. These plants, besides being subject to injury from the same causes as those of the common turnip, are liable to be greatly hurt by hares, rabbits, and different kinds of birds, feeding upon both their tops and roots, which sometimes are almost wholly consumed by them.

In respect to the quantity of produce, there seems to be a considerable difference of opinion among cultivators; but where the crop is put in sufficiently early, and the ground prepared and managed in the manner that has been directed above, it will probably equal that of the common turnip. And when it is considered that the roots are more solid, and abound more with nutritious matter, the *real* quantity of food which they afford may probably be greater. In an experiment in the transplanted method, upon ridges of the same dimensions as those used for the common turnip, the produce was found, after they had sustained the frosts, in the month of March, without either tops or tails, and when perfectly free from dirt, to be thirty-two tons on the acre. And as an advantage in the feeding of horses for a few acres, they have been estimated as high as thirty pounds the acre. With others the crops, on trial, have likewise been found in general to be heavier than those of common turnips; though in appearance from the closeness of their texture, they did not seem to equal them. It is obvious, however, that in common the quantity of produce on the acre must fall considerably below such estimates, and the value of the crop in any application be rated much lower.

There can be little doubt but that this root may be of great utility and advantage in its application in the keeping of live stock in the late winter and early spring months, when the common turnip is liable to spoil and run to seed; as it is much more easy to preserve



in a sound state, being found, when taken up, to resist the effects of the season without any difficulty or trouble, though when left in the ground sometimes liable to be injured. By being stacked, and having the tops removed when they first begin to shoot, they may be kept till the latter end of May, or even much later. In this way they supply the farmer with a valuable food, for the difficult and distressing period when turnips or other sorts of food become scarce, useless, or exhausted, and the grass is not ready. Every cultivator, who has ground suitable for it, ought therefore to have a quantity of this sort of crop proportioned to that of his live stock, to bring to his assistance the latter end of March and in April, or perhaps later.

Neat cattle are said to fatten considerably faster upon this root than that of the common turnip: and when given to milch cows, it has not it is said the effect of injuring the flavour of the butter so much, but communicates to it a fine yellow colour. It has also the property of rendering the milk more rich.

Sheep are found to be extremely fond of feeding upon it; but its hardness renders it more difficult of being eaten. And for hogs it is said to be equal to potatoes. In the keeping of labouring horses it is likewise asserted to be of the greatest utility, rendering less oats necessary, and not proving of so laxative a nature as most other roots. The method of applying it in this intention is, after cutting off the tap-roots, to have the rest of the bulb cut or chopped, being first well washed, into rather large pieces, by means of a sharp hoe, acting in a perpendicular manner, a suitable quantity of the roots being put into a sort of high tub contrived for the purpose. More than are necessary for the consumption of the day should not be cut at a time, as they are liable to be much injured by becoming dry.

But though the *ruta бага* appears to be a root of considerable utility, especially for the more northern districts, where the common turnip must frequently fail from the severity of the winters, it has been objected to as being injurious to the teeth of sheep from its great hardness, as difficult of being raised from the ground on account of the number of its roots or fangs, and as hurtful to the land from its being continued upon it to so late a period: but where it is cultivated and managed in the manner that has been mentioned above, there will be little danger to be apprehended from the first; and in taking up the roots, where the soil has been in a proper condition for the crop, there is by no means that difficulty or trouble that has been supposed: and the hurtful effects of their remaining upon the land to so late a period, and thereby preventing it from being seasonably prepared for other crops, may be easily obviated by drawing and stacking, or by arranging the roots close to each other in an upright manner in any convenient situation, as in these ways they will not sustain any injury from the severity of the season.

*Cabbage*.—That the culture of this vegetable is of great importance, as a winter and spring food for different sorts of live stock, on all those stiff and strong soils that are too moist and heavy for the successful practice of the turnip husbandry, is sufficiently shewn by the great advantages that have been derived from it in those districts where it is grown to a considerable extent. And this is farther en-



forced, by the little danger that attends the crop, and the largeness of the quantity of food that is produced; as it has been found to be considerably larger, in proportion to the space of ground that is occupied, than that of turnips.

In the field culture of cabbages, several different sorts are capable of being employed; but those varieties that are the most useful as cattle food, and the most capable of withstanding the severity of the winters in this northern climate, are the *Scotch Gray*, the *Drum Head*, the *American*, and the *Open Green* cabbage or *Spring Kale*. The first, when of the true kind, has been found to be wholly incapable of being injured by frost, except, in some cases, a few of the outside leaves. The second sort, or true drum-head, is likewise extremely hardy, and more close in its texture than many other varieties, being of course very heavy in proportion to its size. It admits of being planted closer than the large American cabbage, which in particular situations is an advantage. This sort is known in some districts by the name of the *tallow loaf* cabbage; but it would seem to differ from it in some respects. As this kind is not found sufficiently hardy to bear the effects of very severe frosts, a mixed stock is frequently employed, which is produced by planting it and the common red cabbage together, and, after the seed-pods are formed, cutting down the latter and leaving the former for seed. This mixed kind, which is of a deep green colour veined with purple, besides retaining the size of the drum head, possesses the hardness of the red cabbage. The third, or American kind, has not only a large size, but continues good to a late period in the spring. The last, or kale sort, is perfectly hardy, and capable of being converted to use as a cattle and sheep food, at the latter end of April or beginning of May, when other sorts of green feed are extremely scarce and difficult to be procured.

Besides these, the varieties known by the titles of the *Flat Dutch*, the *Yorkshire*, the *Savoy*, and several others, may be made use of in situations where the climate is more mild.

The chief advantage of planting large-sized cabbages in the field is, that of their being capable of being set out at such distances as to readily admit of being cleaned and kept in order by the plough, without any loss being sustained in the quantity of produce. Where the soil is not of great staple, and the expense of hand labour reasonable, the smaller sorts may occasionally be made use of with advantage. From the great size, and the roots of plants of the cabbage kind penetrating into the ground to a considerable depth, they should constantly be planted out in such soils as are strong and have a good depth of mould; as where this is not the case they seldom attain their full growth. The moist friable loams and loamy clays, on which turnips cannot be grown to advantage, are probably the best adapted to this sort of crops; but they may be raised with success on almost any of the heavier descriptions of land.

In the preparation of the ground, as the roots of the plants run deep, and stand in need of a large proportion of nourishment, a considerable degree of pulverisation should be effected, and the soil be well loosened to a good depth. These effects may be produced



in the most perfect manner, by repeated deep ploughing, and exposing as large a surface as possible to the action of the frosts during the winter season by laying the land up into pretty high ridges. Three ploughings are mostly found sufficient for this purpose; but the number should always vary according to the nature and state of the land. When this sort of crop succeeds wheat, barley, oats, or beans, the land is generally ploughed up in the autumn by a pretty deep furrow, and formed into ridges of about three feet in width; in this state it may continue till the spring, when it should be well broken down by harrowing in different directions. It is then to be ploughed again, but with somewhat less depth than before. After this, as near as possible to the time of planting, the ground may again be well harrowed over, and a suitable proportion of good stable manure applied, as from fifteen to twenty three-horse cart loads to the acre: or, where composts are made use of, from twenty to thirty, are immediately turned into, or inclosed in, the middle of the ridges. After this is accomplished, the land becomes ready for the reception of the plants. In some districts, however, a practice prevails of spreading the manure upon the land and turning it in with the first ploughing. In this way the ground is supposed to be prevented from becoming too open by the action of the manure, and the danger of the plants being injured in drougthy seasons prevented. It is obvious, however, that in this mode much of the benefit to be derived from the manure must be lost by its remaining so long incorporated with the soil before the plants are put in, and that the great advantage of having it in its most active and concentrated state immediately below the roots of the plants must be wanting.

*Seed.*—In the selecting of seed for raising young cabbage-plants, great care should be taken that it be procured from the most perfect plants of the different kinds, and such as have seeded without any others of the *same tribe blowing* near them, as it is perhaps only in this method that they are capable of being kept of a true kind. In this intention it may be of great advantage to have the plants intended to stand for seed planted out by themselves in a piece of ground at a distance from the others; and as birds are remarkably fond of the seed, well secured from them. In purchasing seed of this sort, such as is new should always be preferred, as it not only vegetates much quicker, but is more to be depended upon for a proper supply of plants. In dry seasons, steeping the seed in water, or some other liquid, may also be of utility. The beds on which the seed is sown should be of a good rich quality, well prepared by digging and the application of manure; as, where the soil is poor and not sufficiently enriched by manure, the plants are apt to be weak and stunted in their growth, as well as much injured by the rising of weeds. Much injury frequently arises to young cabbage plants from the seed being sown too thick; care should, therefore, be taken to have them properly thinned out whenever they come up in too thick a manner. One ounce or an ounce and a half of good seed may in general be sufficient for sowing a bed fourteen or fifteen feet long, and five or six feet in width, or for raising two or three thousand



good plants; in which proportion half a pound will afford more plants than are sufficient for planting an acre.

*Time of sowing.*—The periods of putting the seed into the ground must depend much upon the intentions of the cultivator: where the produce is to be consumed during the winter months, as in December, January or February, the seed should be sown in July or August the preceding year, and the plants be put out in March, April, and May, the following year; but if it be intended for consumption in March, April, or May, the seed should be put in about the latter end of February or beginning of March in the former year, and the plants be set out the first or second week in June and July in the same year. By continuing to sow with regularity in the months of February, May, and July or August, successive crops of young healthy plants may be secured, and the round of cabbage husbandry be effectually preserved. These periods of sowing and transplanting should, however, be attended to with considerable exactness, in order to secure good and certain crops, and the seed-beds be well protected from birds. And that the cultivator may not be disappointed in the number of plants, it may be useful to sow a little seed at different times, at the distance of a few days, always choosing as moist a time as possible. But by hastening or protracting the times of transplanting, or setting out the crops, the growth of the plants may be so managed as to have them ready for use either more early or later, according as circumstances may require.

By sowing very early in the spring, and setting the plants out as expeditiously as possible, both full and forward crops may often be obtained. There is, however, in general, an advantage in the autumn plants, that though they be more liable to be injured in the winter by slugs, and other causes, they are in a state to be planted out very early in the spring, while those of the spring sowings can seldom be set out till the summer is much advanced. By sowing in May or June, forward crops of large cabbages may be procured the ensuing year, or coleworts for the following spring; but in this last intention they should be planted closer together than usual. In this way the loss of weight, and danger of cabbage crops in winter months, are fully obviated.

On the whole, the sooner the autumnal plants are put out in the field after the frosts are over, the better; and the spring plants should be placed out as soon as possible after them, as before the end of April.

*Method of planting.*—In the planting out of this sort of crop, care should be taken to have the business performed as soon as possible after the land has been well saturated with rain; as in this case the plants much sooner establish themselves in the soil, and fewer vacancies are left by their decay to be afterwards filled up. The plants are likewise much more readily raised from the seed beds, and with much less injury to their roots, which is a matter of more importance than is generally supposed. The business is performed upon the land when in its flat or level state, and also when raised into ridges by means of the plough; but the latter method is the more general, and ought probably to be preferred wherever the soil



is much inclined to the retention of moisture. On the lighter and more dry soils the flat surface may, however, be more advisable.

The distance of planting must depend in a great measure upon the strength and goodness of the soil, and the natural size of the variety of cabbage that is employed; but in general it should be such as that the ground between them may be cultivated and kept clean by the plough, and yet admit of bearing a full crop. It is obvious that where the plants stand thin they will attain a larger size, while in close planting there will be a greater number upon the land, which may compensate the disadvantage of want of size. It seems probable, however, that both cabbages and turnips may be set out too thin, as the increase of size is not always equal to that of number.

It is the practice of some districts, where this culture is well performed, to set them out regularly, at the distance of three feet each way, as in this method the plough in cleaning and earthing up the crops can be conducted both in a longitudinal and cross direction, and of course the soil between the plants be not only stirred in the most effectual manner, but the most completely laid up to the roots of the plants, and their growth the most fully promoted. Where the larger varieties of cabbage are employed, and the land is sufficiently strong, this may therefore in general be the most advantageous distance; but where the smaller varieties are made use of, and the ground is of a less strong and rich quality, two feet and a half may be the most proper and beneficial distance. Other cultivators, however, follow a different practice; some preferring four feet by two feet and a half, while others advise only two feet by twenty inches, or even eighteen inches. In these distances the cabbages are, however, under the necessity of being hand-hoed between the plants in the rows; the intervals only being cleaned by the plough.

But whatever distances may be thought the most advantageous, it will constantly be necessary to attend to the manner of setting them out, the size of the plants, and the mode of taking them up from the seed-beds, as much depends upon these operations being properly performed. In setting the plants out, in the ridge method, it is necessary to have them placed in lines as regularly as possible, according to the distances employed, along the middle or crown of the ridges, immediately upon the part in which the manure has been inclosed; as by having this accomplished in an accurate manner, they not only admit of being cultivated betwixt with more ease and convenience, but derive the utmost possible advantage from the manure, and at the same time, from its being more concentrated, require a smaller proportion to be employed. In regard to the size of the plants the large stout plants not only take root with more certainty, but are less exposed to danger from slugs and other causes. In removing the plants from the seed or other bed, for the purpose of being planted out, it is also of much utility to have their roots as little broken or otherwise injured as possible. Moist or rainy weather is the most suitable for this operation; but in dry seasons it may be well accomplished after the plants in the



beds have been well watered. The number of plants that are employed must obviously be different, according to the distances at which they are planted; but from five to seven thousand are generally sufficient for an acre of land. In setting the young plants out in the ground, it is necessary to see that the labourers fix them well in the soil, by applying the mould so firmly round their roots by means of the dibble, that they cannot be easily drawn out by taking hold of their uppermost leaves. The plants are mostly dropped at proper distances, by women or children, and the dibblers follow, having a stick for marking the distances with in an exact manner. In this way an ordinary labourer will plant a quarter of an acre or more in a day, and an expert gardener nearly as much more. In the course of a fortnight or three weeks after the first setting out of the plants, it will be requisite to fill up all the vacancies that have been produced by the failure of particular plants; in performing which a moist time, if it be possible, should be chosen. Mr. Young has however advised it, as a more certain and advantageous method, to drill the seed where the plants are to grow in the beginning of April, after some sort of hoeing crop, such as turnips, tares, potatoes, beans, &c. prepared by being ploughed into three or four feet ridges. In March the manure should be deposited in the furrows of these ridges, to the quantity of from twenty to thirty cubical yards to the acre, according to the land. After having remained in this state a fortnight, the lands should be harrowed where stiff or heavy, but in other cases omitted; the seed is then drilled in by the Northumberland drill hung to a roller eight feet in length, where the ridges are four feet, and six feet in length, where they are three feet in breadth. This is done by staples for the purpose in the frame of the roller, a chain hooking the drill to them. The roller covers the ridge which is drilling, and one in advance to be drilled by the next turn. The work proceeds regularly in this manner: four pieces of jack chain about two feet in length being attached to the drill, and drawn after it in the centre, serve to cover the seed. The depth of depositing the seed is regulated by pressure or weights laid on the drill. When the plants are just above the ground, it is beneficial to drill soot over them by a properly contrived drill, in the proportion of ten or twelve bushels to the acre, as a preservative against the fly.

The expense of planting out, as well as of all the other operations in crops of this sort, must be liable to vary greatly, according to the circumstances of the soil, and the situation in respect to labourers. In Suffolk, according to the writer of the Corrected Report of the Agriculture of that district, it is in general about three shillings the acre; but in other places it is frequently a little higher, the whole charge of an acre being estimated at about 5*l*.

*After-culture.*—There is scarcely any sort of crop that derives more advantage from having the mould or soil frequently stirred and applied to the roots of the plants, than that of the cabbage. It is only by a due repetition of these operations that the plants attain their most perfect growth and size. The work is accomplished by means of ploughs, horse and hand-hoes. Where the



plants are set out in a regular manner at sufficient distances, the business may be performed in the most cheap and effectual way by the use of the horse-hoe, or the common light swing-plough; but where narrow distances are employed, this work can only be well executed by means of the hand-hoe. Sometimes both the horse and the hand-hoe are made use of; as where the crop is planted close in the rows, with wide intervals. The number of hoeings must in general depend upon the state of the land and the nature of the season; but three will in most cases be necessary. The first should be given about three weeks or a month after planting, according to the growth of the plants; and the second at about an equal distance of time. The third may be repeated as the necessity of the crop may require, attention being constantly paid to keep the land perfectly clean from weeds, and the earth or mould well loosened and laid up to the plants. In the first operation it is usual to turn the mould or soil from the plants, but in the subsequent ones to apply it up to them, which, where the plants are set regularly in squares at the distance of three feet, may be performed in both directions of the ground, in the most perfect manner. In this way the cultivator not only in a great measure avoids the heavy expense of hand-hoeing, but contributes to the growth of the crop in the most effectual manner. In executing the work, by means of horse labour, some make use of the horse-hoe, others the double mould-boarded and common hoe ploughs; and it has been contended, that it may be effected with equal exactness and in an equally effectual manner by any common light swing-plough. After these hoeings have been accomplished, the hand-hoe may be occasionally employed just about the roots of the plants, if there should be necessity. And where the crops are planted out at narrow distances either wholly or in the rows only, it must altogether or in a great degree be depended upon for the after-culture of the crops. In these cases, two or three hoeings are mostly found necessary. The expense of each hand-hoeing in such crops is in general from two shillings to half-a-crown or three shillings the acre.

When the crops are sown in the drill method in April where the plants are to remain, they should be thinned out the following month when the plants are about three or four inches in height, by hand-hoeing, in order to the next operation of this kind, which is to leave them at the proper distances, as eighteen or twenty-four inches as the nature of the soil may be.

Cabbage as well as turnip crops are liable to be injured by the attacks of animals of the insect kind at different periods of their growth. While the plants are young and tender in the seed-bed, the *beetle* or *fly* often greatly injures or destroys them by its ravages. The plants likewise occasionally suffer in the seed-bed from the attacks of the *caterpillar*, produced by the cabbage butterfly, though less frequently, as this insect makes its appearance in general too late to do much injury to field crops.

The *slug* sometimes also does much harm to cabbage plants while young, and on their being first planted out, but afterwards they are



little exposed to its attacks. The depredations of the fly or beetle, as well as the caterpillar, may in general be in a great measure prevented by the sowing or dispersing of wood-ashes, soot, or other similar matters in a powdery state, over the young plants on the first appearance of the insects among them. And the ravages of the slug may be guarded against by the means that have already been recommended for turnips. But besides the attacks of insects on the leaves of the plants, cabbages are subject to a disease in the roots; in which they become swelled out and knobby, and the plants weak and of imperfect growth. This vegetable disease has been supposed to be caused by the attacks of grubs below the surface of the ground, and to be chiefly prevalent where the same sort of cabbages are sown and planted on the same spots of ground for several years together.

It is scarcely possible to ascertain the quantity of produce that may be derived from an acre of land under a crop of this kind, as it must depend in a great degree upon the quality of the soil, the proportion of manure that is employed, the method of culture, the goodness of the plants, and the favourableness of the season about the time of planting them out. It may probably in general be estimated at from twenty to thirty tons. In comparing the produce of cabbage crops with those of turnips, in different modes of planting and on different kinds of soil, it was found, taking the best parts of the crops, that a medium acre of the former, on good land, well managed, produced twenty-five tons, and of the latter fifteen tons.

The value of the crops must likewise be affected by various circumstances, as the kinds of live stock by which they are consumed, the manner in which it is accomplished, and the situation of the cultivator in respect to markets: but in common they may be calculated at from four or five to seven or ten pounds the acre.

In the application or expenditure of cabbage crops, as they are often liable to a considerable diminution in the quantity or weight of food which they contain, by standing over the winter to the spring months, it may be the best and most economical practice to make use of them late in the autumn, while their leaves are in perfection, in completing the fattening of such neat cattle or sheep as have been brought considerably forward in the pastures during the summer season. In this way there is much less loss sustained than is generally the case where they are suffered to stand for spring feed, by the decay and destruction of the outside leaves and other parts of the plants. In the feeding of milch cows at the same period they may likewise be of very great utility, as supplying a large proportion of green food, whether the whole plant be made use of, or only the more loose green leaves, which may often be removed without much injury to the cabbages. In this method of application they have been shown to be more beneficial than hay, given in any proportion, when only combined with straw; and that the butter is not in any way injured by them while they are given in a sound state. When employed in this way without any combination of



other sorts of food, as hay or straw, an acre has been found to be sufficient for four or five cows, and with straw and a little hay for seven or eight.

In the fattening of neat cattle, an acre of good cabbages may be nearly sufficient for three beasts of from forty to fifty stone each which have been grazed in the pastures during the summer. A middle-sized bullock consumes, in general, of this sort of food, in the proportion of about one hundred pounds in twelve hours; but much in this business must constantly depend on the state of the stomach and the methods of feeding the animals. It would, however, seem probable, that cabbages possess the property of fattening cattle, not only more expeditiously but in less proportion than turnips; an acre of the former having been found to fatten one in four more than the same extent of the latter crop.

In feeding this crop off with sheep it has been observed, that such as weigh about twenty pounds the quarter consume in the proportion of from eight to ten pounds in twelve hours, half an acre being nearly sufficient for one hundred sheep when the crop is good.

Where cabbages are employed for winter and early spring consumption, it has been advised by some cultivators to have them cut or drawn while in full perfection, and piled up in houses for the purpose, or stacked up in the open air, being closely covered over by means of straw, broom, rushes, or any other similar cheap material; as in this way they are constantly ready and at hand, when they cannot be procured from the field, on account of the wetness of the land or the effects of frost and snow.

In whatever manner cabbages are consumed, it is of importance to the succeeding crops that they be wholly removed from the land in the early part of the spring, before they begin to throw up their flowering stems and run to seed.

It has been suggested by a late writer, that in cases where turnip crops have either wholly or in part failed, and the soils are of an ordinary depth, the lands may be recropped with cabbages at a cheap rate, and with the greatest chance of success. This may, therefore, be a point that deserves the notice of the extensive turnip cultivator on all the stronger kinds of turnip land.

*Turnip Cabbage.*—This is a plant that has been long known to the horticulturist, and which was attempted to be introduced into field culture many years ago, but without complete success, notwithstanding the results of the experiments that were then made upon it, appear to have been much in its favour. In this variety of the cabbage the bulb or apple is of a roundish flat form, appears principally above the surface of the ground, and is as it were an enlargement of the stem of the plant, the leaves that surround it having much resemblance to those of brocoli. It is said to be more hardy against frosts than the Swedish turnip, which is a property that must render it highly beneficial in many cases. It has sometimes been cultivated under the title of *Cape Cabbage*, and often confounded with the *Turnip-rooted Cabbage*, by those cultivators who have not sufficiently attended to the circumstances by which



they are distinguished. It seems to be the plant cultivated in many parts of Germany under the title of *Kohlrabi*, and which is said to be extremely hardy.

The soils that are the most adapted to the growth of this plant are those of the more light and dry kinds, that have some degree of elevation in respect to situation, and which are in a good state of fertility, from previous tillage.

The land is to be prepared by ploughing three or four times, in nearly the same manner as for the common turnip, being laid up in the autumn, in order to be rendered fine and mellow by the action of the frosts and other causes during the winter. After being thus well prepared, at the time of planting, it is to be ploughed into small two-bout ridges, and a suitable proportion of manure, according to the state of the soil, turned in. On the ridges, when flatted by a light roller, the plants are to be set out.

*Seed, and Time of Sowing.*—In collecting the seed, the same method should be pursued as has been advised for cabbages, in order that no adulteration may take place. In cultivating this plant the seed is sometimes sown in beds in the fields, whence the plants are afterwards to be set out, and at others in drills or broadcast, where the plants are to remain, being only thinned out to proper distances by the hoe. The first method is probably in general to be preferred, though some cultivators contend that the plants succeed better when not removed from the places in which they were deposited when sown. Where the transplanting method is practised, the seed should be sown sufficiently early to have the plants of a proper size, as of about six or seven weeks growth, at the time of transplanting. About the middle of March or beginning of April may be the properest periods. The seed in these cases should be sown very thin, and the weak plants afterwards thinned out, till they are left at not less than three inches distance from each other. Five or six ounces of seed will in general be a proportion sufficient for affording plants for setting out an acre of ground. In the drill method the same proportion of seed may also in common be sufficient, which should be put into the soil about the beginning or middle of April; but if sown later, as in May or June, it frequently succeeds. On the broadcast plan, from the plants not coming quickly to the hoe, the latter end of March may probably be the most suitable period for sowing. In this method, the proportion of seed must be somewhat increased.

*Method of Planting.*—Crops of this sort may be planted out either upon the plain surface of the ploughed ground, or after it has been thrown up into ridges in the manner described above; but the latter is by much the best method, especially where the land is not perfectly dry. The most eligible time of performing the business of planting is, as in the common cabbage, when the land has had a good shower of rain, the operations of ploughing and setting out the plants proceeding together; but neither operation should be attempted when the land is much soaked with the rain, as much injury is not only done to the land, but the plants seldom thrive well. In planting out different distances are practised, some preferring



the distance of two feet from row to row, and eighteen inches apart in the rows where the soils are good, but in those of inferior quality, not more than twelve; while others advise their being planted two and a half or three feet asunder on two bout-ridges, the plants being placed as nearly as possible in the middle, immediately upon the dung, as has been recommended for cabbages.

*After-culture.*—This business must be performed in different ways, according to the methods of sowing or planting that have been practised. When the seed is put in by the hand, the crop can only be kept clean by means of the hand-hoe, which should be applied as frequently as is necessary for the purpose.

In the drill mode, as well as where the crop is planted out with broad intervals, and narrow distances in the rows, it may be convenient to make use of both the plough or horse-hoe and the hand-hoe, employing the former in stirring and clearing the intervals, and the latter in keeping the ground between the plants clean. When the crop is planted on ridges, it is recommended, that as soon as the plants have become firmly established in the soil, and weeds begin to appear, to throw a furrow from each side of them by means of a small plough that is narrow behind, stirring the parts not thus moved by the hand-hoe; and after the decay of the weeds thus turned down, but before the plants get too large, to return them to their former situation, care being taken not to cover the hearts of the plants with the earth. These operations may be repeated as frequently as the state of the crop may require. It may be necessary to observe, that in the after-culture of this plant, as it forms its bulb above the surface of the ground, the earth or mould should never be laid up so much to the roots of the plants as in the common cabbage, as it may contribute not only to prevent the swelling of the bulbs, but promote their destruction.

In dry seasons this plant may probably be cultivated with greater advantage than that of the turnip, as not being subject to the destructive attacks of the fly, and being less exposed to danger from other animals that are liable to destroy crops of that sort.

In good ground the bulbs or roots of these plants frequently attain a considerable size, the largest sometimes weighing eight or ten pounds, and are said to be much more hardy than the common turnip, though not so much so as the *turnip-rooted-cabbage*. The quantity of produce on the acre is not probably in general equal to that of the common turnip.

Its application is chiefly in the feeding of neat cattle and sheep, during the autumn or spring months, according as it may be sown more early or late; but the most profitable consumption of it is probably in the latter season, as from the middle of March till it is removed from the ground. In this way it may become an useful assistant to crops of the turnip kind. For this use it possesses a particular advantage, on being formed, as it were, upon a foot-stalk above the surface of the earth; as it can on that account be more conveniently got at and removed during the time of frost, or when snow is upon the ground, than the common turnip. The propor-



tion of nutritious matter contained in crops of this sort is considerable, and of a rich quality. Cows thrive extremely well on this food, when it is given them in a judicious manner. When fed off by sheep, the best method is that of hurdling, in the manner practised for common turnips. In this mode of application they are said to require little or no hay, even where the intention is to fatten the animals, as they make a greater progress with them than on any other sort of food, except that of oats.

Instead of cutting off the bulbs below the parts where they are formed, in order to preserve them in houses for the above purpose, it is the practice of some cultivators to plough them up wholly, using a common plough, without any coulter, having only a round share with a blunt edge, for the purpose. This is passed along under the rows, and performs the work with much ease and expedition.

*Turnip-rooted Cabbage.* This is another plant of the cabbage kind that has been introduced into field culture with considerable success. It differs principally from the former in forming its bulb or protuberance below the surface of the ground, in having it of an oblong shape, and in the leaves having a considerable similarity to those of the common turnip.

The most suitable soils for the growth of this sort of vegetable are those of the more friable loamy kinds, or such as have been formed by the gradual deposition of earthy matters from the overflowings of large rivers or the sea. But of whatever kind the soil may be, the particles of it should have been well broken down and reduced by means of tillage, and not be too retentive of moisture, when plants of this sort are cultivated upon it. It should also be enriched by the application of manure, in the proportion of eight or ten waggon loads to the statute acre, which should be turned in with the last ploughing in forming the one-bout ridges for the reception of the plants. This is sometimes performed by the common plough, but it may probably be executed with more exactness by one with a double mould-board.

*Seed.*—This is to be constantly collected from the best and most perfect plants of the kind. It should likewise be employed while it is perfectly fresh, as such seed as has been kept for some length of time seldom comes up well, or with much regularity. But where it is necessary to make use of it, the best method is to steep it in water for a few hours before it is sown.

*Time of sowing.*—This is to be performed sooner or later, according to the intentions of the cultivator in respect to the consumption of the crop, but for the summer planting, the best time may be about the latter end of March, or beginning of April. For this purpose a piece of ground should be prepared by repeated turning over during the winter, so as to become perfectly fine and free from weeds. This must now be covered over by some well-reduced farm-yard manure, adding a little fresh horse-dung from the stable. This is then to be turned lightly in by means of the spade or plough, and a suitable proportion of seed sown over the whole, being co-



vered in by means of a strong rake or light harrow. As the plants rise, attention is to be paid to the fly, guarding against its attacks by the use of wood-ashes or soot, when it first appears.

When the plants are found to grow too fast or advance too high in the stems before the period of setting them out in the field, so as to attain an improper shape not easily afterwards removed, it may be necessary to draw up the whole of the plants clean on one side of the bed, digging or turning the soil over in the place where they stood, to the depth of four or five inches, with the spade, putting the plants in the trenches in the proportion of forty or fifty in each yard, the roots being covered by the earth taken out of the succeeding trench, and slightly trodden down upon them. In this manner the whole of the plants that require it, are to be entrenched: by which their improper growth may not only be checked, but the plants be rendered more fit to be set out in the field. Where the land for the seed-bed has, however, been properly prepared, and is perfectly freed from weeds, this process will seldom be found requisite.

*Method of Planting.*—This sort of plants may be set out in the same manner as the turnip cabbage, either upon the plain ploughed surface, or after the land has been raised into ridges, in the way described above. The latter is, however, to be preferred, especially where the soil is inclined to be moist. They are planted at different distances, according to the goodness of the land, but the most general practice is from two to two and a half or three feet. In the ridge method it is usual to set them on the middle of the ridges, at the distance of two feet in the rows. The plants are to be carefully drawn from the seed bed towards the latter end of June, for the summer planting, when of the size of good large cabbage-plants. And in order that as little injury as possible may be done to their roots, this business should be performed immediately after rain, or after the beds have been well watered. They are then to be made up into small bundles, and distributed by women or children singly along the ridges, or on the plain surface of the land, at proper distances, to be directly put into the soil by the dibblers; in doing which, they should be plunged up to the place of the branching out of the leaf stems, the mould or soil being firmly closed about them in the manner recommended for the common cabbage plants.

Care should likewise be taken that a greater number of plants be not drawn from the seed-bed than can be planted out the same day, and that they be as little as possible exposed to the action of the sun and wind. It is also necessary for a few days to guard against their being pulled up by rooks or other birds.

*After-culture* —This is to be carefully attended to here, as well as in all other crops of a similar kind. In about ten days or a fortnight, when the plants grow well, they will in general require the assistance of the hand-hoe, to clear the ridges and give the plants a slight dressing. And as soon afterwards as may be convenient, the intervals may be cleared either by the common plough or any other more suitable implement, by passing them twice along each, turning the furrows, where the land is clean and not too close or compact,



up towards the rows, being careful not to earth up the plants to too great a height: but where the contrary is the case, they should be turned from them, so as to form a ridge in the middle of the interval, the implement being passed within a few inches of the plants in performing the operation. This ridge in dry seasons should be split down and returned to the rows again in the course of a few days; another hand-hoeing being given as soon afterwards as may be found convenient.

The produce in crops of this kind is frequently found, on good land, to be from twenty-five to thirty tons on the acre.

As the plant is a native of a more cold and northern climate, it of course retains in some measure the late habits of the situation from which it was originally brought, and becomes proper for the purposes of feeding live stock at a later period in the spring than many other plants to which it has a resemblance. It is seldom before the middle of April that the juice begins to rise and the plant become proper for being fed upon. About this time, however, as is shewn by the bushy appearance of its top, it begins to push forward and be in a condition to be made use of. When employed before this period, it is said to be comparatively of little advantage, and in some cases even injurious to the animals that feed upon it.

Its principal application is in the feeding of sheep, which animals are confined upon portions of the crop by hurdles, in the manner practised for the common turnip. The roots are, however, to be pulled up and prepared by being cut in two by means of an implement of the mattock kind, having a claw on one side nine inches long, with a transverse edge at its end two inches in width, and on the other a sort of cleaver; with this tool, acting as a lever by means of the handle, the roots are readily taken up, after which any dirt that may adhere to them is shaken off by a blow or two, and the roots split by the cleaver. By this means the sheep begin in the centre of the roots and proceed outwards, eating them with more ease and much more completely than in any other method. When they are not cut, the hard substance of the rind renders them difficult of being eaten by these animals. One-year-old sheep, or what are frequently denominated *tegs*, wethers, and all dry sheep, may in preference be fed on this root; but when ewes and lambs are to be kept upon it, the hurdles must be so contrived as to admit the lambs to pass through them to feed at large, as by this means both they and the roots will be much benefited.

*Rape or Cole.*—This is a plant of the cabbage kind\*, but which differs from it in not forming a close head. As being of an hardy nature, and affording a large proportion of green food for the winter support of sheep and other animals, it has been some time introduced as an article of field-culture. It has likewise been cultivated for a considerable length of time for the use of the seed, which is expressed in mills constructed for the purpose, in order to form the oil known by its name.

The soils most adapted to the culture of this plant are those of

\* *Brassie napus.*



the deep and more fertile kinds: when it is grown on lands that have been long in tillage, the friable loamy kinds are found to answer the best; but it may be grown with perfect success on the fenny, marshy, boggy, and other coarse waste lands, that have been long in the state of grass, after being broken up and reduced into a proper state of preparation. As a first crop on such descriptions of land it is often the best that can be employed. When sown on old tillage lands, the method of preparation is pretty much the same as that which has been given for the common turnip; but if the seed be intended to be put in upon lands that are newly broken up from the state of sward, they must be rendered perfectly clean and in a sufficiently fine state of mould for the reception of the seed, either by frequent ploughing in the common way, and afterwards harrowing the surface well by light short-tined harrows; or by having recourse to the practice of paring and burning, which may be performed in the manner already described\*.

If sown on the first sort of preparation, it is the best practice for it to succeed wheat or barley crops. When the former, barley or oats, with grass-seeds, may be put in after it; but if the latter, it may be succeeded to the greatest advantage by wheat, as it is found to be not only an excellent preparation for that sort of grain, but to afford it of the finest quality; and by its being taken off early there is sufficient time allowed for getting the land in order for the wheat crop. Where the tillage land is not in a good state of fertility, manure of the same kind and in the same proportion as for turnips should be applied and turned in with the last ploughing for the seed.

*Seed.*—For this crop such seed as has been perfectly ripened, is quite fresh, and has a fine black colour, is constantly to be preferred, as vegetating in the most perfect and expeditious manner. The quantity of seed that is made use of is in general from a quarter to half a peck, according to the manner of sowing that may be practised. Where the crop is intended to be consumed as a green food for animals, a larger proportion of seed may, however, be necessary than where the obtaining of seed is the chief object of the cultivator.

*Time and Method of sowing.*—This sort of crop is sown at different times according to the different methods of its application: when intended as a sheep feed, it may be put in any time in June or July; but if it be for seed, August is the proper season. In the Flemish method, according to Mr. Young, it is sown on a seed-bed for being transplanted in October and November, being set out on an oat stubble after one ploughing. The most common practice here in putting this crop into the ground is that of dispersing it in as regular a manner as possible over the surface of the ground by the hand, covering it by means of a bush or other light harrow.

The drill method has also been practised with this crop, the seed being deposited to the depth of one inch in rows on every other land, twelve inches asunder. The superiority of this mode over that of the broadcast appears considerable in the statements that have been

\* Section on Paring and Burning.



made of it, as the land is capable of being kept clean with less difficulty and expense.

It has been suggested likewise as a desirable method to sow the seed in beds, for the purpose of being afterwards transplanted into the field and set out in the manner of cabbage-plants. Half a rood of land in this way would be sufficient to furnish plants for five or six acres. In this manner, as well as by pulling the plants from the places where they may stand too close in the field, the vacancies that frequently occur in this sort of crop may be filled up, the work being performed by dibbles.

When cultivated for use as green food, the seed should, as has been seen, be sown more early than where the crop is to stand for seed, or be employed in both ways; but sufficiently early to get a strong leaf without running to stem the first autumn. The middle of June and the last week in July, as mentioned above, may be the most proper periods.

*After-culture.*—In the general broadcast method of cultivating this crop, proper attention in hoeing and keeping it clean from weeds is seldom bestowed, though it is equally necessary as in almost any other, and in order to ensure a full and abundant produce ought never to be omitted. Where this business is attended to, it is the practice, after the plants have attained two or three inches in height, put out six leaves, and begun to spread and shew themselves perfectly above the ground, to hoe them over by means of a hand-hoe somewhat smaller than that employed for turnip crops, setting the plants out to the distances of from six to eight or nine inches from each other, according to their vigour or strength and the fertility of the soil. This is the only hoeing that is in general given; but in many cases, as where the land is poor and disposed to throw up weeds, much advantage may be derived from a repetition of the operation, not only in cleaning the ground, but promoting the growth of the plants, by stirring the mould round them. This should be done about a month or five weeks after the first hoeing. The expense of performing the work once, is mostly about six or seven shillings the acre.

But in the row methods, whether by drilling the seed or transplanting the young plants, the business of hoeing may be performed in a more perfect and cheap manner, on account of the greater distances of the plants admitting the earth in the intervals to be stirred by the plough or horse-hoe, while hand-labour becomes only necessary between them in the rows. In this way a garden cleanness may be preserved in such field crops at no great expense.

When the produce is intended to be consumed as green food, the crop will in general be sufficiently advanced for the purpose, if there should be a necessity for it, towards the latter end of November; but except where the seed is to be afterwards taken, it is probably a much better practice to reserve it as seed in the spring months. When cut or fed down in the autumn, the plants mostly advance so in the spring as to form a second crop in April. But in



this method of feeding off the crop care should be taken that the plants are not pulled up and destroyed by the animals being confined too long upon them.

If the intention be to let crops of this sort stand for seed, without feeding them down in the autumn, which is a practice often adopted; after they have been well cleaned by hoeing, nothing further is necessary till the latter end of June or beginning of July, when the seed becomes ripe. This is shown by the pods putting on a brownish appearance, and the seeds in the forwardest of them turning a little black. This should be nicely attended to, as, if suffered to remain too long uncut, much seed may be lost. They are usually reaped with the sickle, and laid in thin *gripes* or *reaps* upon the place where they grow, until they be in a proper condition for threshing. This is known by the straw becoming of a whitish colour, and the seed appearing perfectly black. If, however, they remain upon the ground too long, much of the best seed may be lost; and if threshed in too green a state, much may be left in the pods; as well as what is threshed out be difficult to cure or preserve.

In these cases, the seed is threshed out in the field upon cloths about twenty yards square laid upon the ground; or what is better, upon wattled hurdles, so placed as to have an inclining direction; cloths being placed underneath to secure the seed. The rape is conveyed to the place by means of sledges, the bottoms and sides of which are lined with cloth in order to preserve the seed that may escape in the operation. It is sometimes likewise cleaned in the field, and put into sacks for the market. When large quantities of seed are brought quickly together; as they are liable to heat and become mouldy, it may be a better method to spread them out thinly over a barn, granary, or other floor, and turn them as often as may be necessary.

In some parts of Yorkshire this business formerly constituted a sort of festival \*; but it is now much on the decline, the method of binding the crop in small sheaves and stacking it in the field being much adopted. The barn ought, however, to be preferred.

The expenses of the different operations, such as reaping, turning, threshing, dressing, and depositing the seed in bags, may in general be estimated at from twenty-five to thirty shillings the acre.

When this sort of plant succeeds well, and the season is favourable for securing the seed, the crops are extremely profitable to the cultivators, forty or fifty bushels or more being frequently produced on the acre. The seed is sold by the last of ten quarters, for the purpose of having oil expressed from it; by mills constructed for that use; the husks, after the oil has been in a great measure squeezed from them, forming the cakes employed as manure. The price varies considerably, but lately has seldom been much below thirty pounds the last.

Rape crops are, however, precarious, both in the early cultivation and the securing of the produce: being often much injured while

\* In the Rural Economy of that district Mr. Marshall has given a full and very interesting description of this business.



young by insects, somewhat in the manner of turnip crops; when in blow, or in the period between blossoming and forming the seed pods, in the spring, as about the beginning of May, by frosts, blight, and mildew; and in securing the crop, if the time of cutting be not nicely attended to, or much rain fall, there is much danger of its being lost or destroyed.

The culture of this crop for seed has been considered by many as objectionable, on account of the great degree of exhaustion of the land that it is supposed to produce; but where it is grown on a suitable soil and preparation, with proper attention in the after-culture, and the straw and offal, instead of being burnt, as is the common practice, converted to the purposes of feeding and littering cattle, it may in many instances be the most proper and advantageous crop that can be employed by the farmer.

The most general application of this sort of crop is, however, as a green food for sheep, in which use it is scarcely surpassed by any other vegetable, in so far as respects its nutritious properties; and those of being agreeable to the taste of the animals: but in quantity of produce it is inferior to both turnips and cabbages. In this application the crops are fed off occasionally from the beginning of November to the middle of April: being found of great value, in the first period, in fattening dry ewes and all sorts of old sheep; and in the latter, for supporting ewes and lambs. The sheep are folded upon them in the same manner as is practised in the consumption of turnips. In this way they are found to pay from fifty to sixty shillings the acre, that quantity being sufficient for the support of ten sheep for ten or twelve weeks. Rape has been found by experience to be superior to turnips in fattening sheep, and in some cases even to be apt to destroy them by its fattening quality. It is likewise observed that that which is grown on fresh land has the stem as brittle as glass, and is superior to every other kind of food in fattening these animals; while in that produced on old tillage land, the stem is tough and wiry, and has but little profit in it.

When neat cattle are put upon this food in its green state, care is necessary that they have not too much of it at first, as they are very liable to be *boven* by it.

It has been suggested by a late writer, that the cultivators of this crop in order to turn it to the best account, should constantly keep in view the circumstance of its being capable of a double application: as by feeding it off with sheep in autumn, the succeeding crop may not be much injured; consequently a large supply of winter food be procured, without the quantity of seed being much, if at all, lessened. This is, therefore, conceived to be the most profitable management in crops of this kind. In some soils and situations this may be the case; but in general, feeding the crop lessens the quantity of seed, as a much larger produce is mostly obtained where this is not practised.

Whether cultivated for the seed or as a green crop for the support of live stock, rape may in many cases be had recourse to as a first crop in breaking up coarse waste lands, by paring and burning, with great advantage: but in the former view it can seldom be repeated with propriety at any very short distance of time.



*Carrots.*—Though this valuable root has been cultivated in a local manner for a great length of time in this country, it is only within the last ten or fifteen years that it has been much applied to the purpose of feeding live stock by the farmer. It would seem to have been introduced into the southern parts of the island from the Low-countries, where its culture and use as food for horses had been long known and practised.

Although there are many varieties of the common carrot\*, there seems to be only one that is proper for being cultivated in the field for the purpose of feeding animals. This is the sort usually termed the *orange carrot*, in which the colour is much more dark than in the other varieties, and the flesh more saccharine and juicy. The root of this variety mostly rises to nearly double the size of that of the pale yellow kind.

The soils on which crops of this root succeed to the greatest advantage are those which have considerable depth of fine mould, either of the friable, loamy, sandy, or vegetable earthy kinds; but they may probably be cultivated to advantage on most sorts, except those of the stiff clayey and thin gravelly or chalky descriptions. The black deep vegetable, and the rich deep sandy, soils, appear however the best calculated for this sort of crop, as well as most other kinds: and the medium sands and sandy loams stand next, as best adapted to its culture.

In the preparation of the land for carrot crops, as the roots of the plants are of the tap kind, repeated deep ploughing is particularly necessary, in order that they may be enabled to push downwards, and distend themselves with facility in the soil; as in this sort of husbandry, where due pulverisation is not effected to a considerable depth, the roots are liable to become forked and of very limited growth, sending off numerous lateral roots, in consequence of their inability to get down; by which the quantity and value of the produce are greatly lessened. This deep tillage may be perfectly accomplished either by means of the trench-plough following the common one, or by the common one alone, with a good strength of team; but the former method is to be preferred, wherever the lands are inclined to be stiff or heavy. Three ploughings are mostly found sufficient, where the land has been previously in a state of tillage; but more may in other cases be necessary. The first ploughing should be made to the depth of ten, twelve, or fourteen inches, and be performed when the soil is tolerably dry, about the beginning of October. It may remain in this condition till towards the middle of February, when it should be turned over a second time, but in a cross direction, to nearly the same depths. In March a third ploughing may be given, in order to the putting in of the seed. This may be somewhat lighter than the preceding ones. By the two deep ploughings being thus given in the autumn and winter months, the ground becomes more open and porous, from being so much exposed to the action of the frosts and other causes, than could otherwise have been the case. At the last ploughing in March a

\* *Daucus Carota.*



suitable proportion of well-rooted farm yard dung should constantly be turned into the soil; the surface of the ground being immediately afterwards well reduced and rendered as level as possible by harrowing. The land is now ready for the reception of the seed.

*Seed.*—The cultivator of carrot crops should always be careful in saving his own seed, by selecting annually some of the most perfect and best shaped roots of the preceding year's growth, to be set out separately about the beginning or middle of March, in an open piece of ground, for the purpose. The seed will be ready about August. By this means the agriculturist will always be in possession of such new or fresh seed as may be depended upon, which is seldom the case when purchased; old and imperfectly ripened seed being frequently blended with the new, by which the crops often either wholly fail, or come up in a very imperfect and unequal manner. Besides, seed of the *pale yellow* kind, or what is termed the *horn carrot*, a sort often cultivated in the Low-countries and in France, but which, as has been observed, does not grow to any thing near the size of the deep orange kind, is often disposed of to the cultivators of this vegetable.

From the lightness of this kind of seed, and its adhering so closely together, other substances have been found necessary to be mixed or blended with it, in order that the seeds may be separated, and sown or dispersed over the ground with more regularity. Saw-dust, bran, ashes, dry earth, and dry sand, have been occasionally made use of for this purpose; but the two first are probably the most proper, as being the most nearly the weight of the seed. Some cultivators, however, think that it may be sown more evenly without any of these matters being incorporated with it, by only being well rubbed and passed through a sieve, to separate it perfectly, after having been well dried in the sun.

The proportion of seed that is made use of varies considerably among different cultivators; but from four or five to six pounds, when sown in a broadcast method, may in general be the most suitable quantity, according as the land recedes from the sandy quality. But where the drill plan by a machine is followed, two pounds to the acre are said to be fully sufficient.

The period of putting this sort of seed into the soil is generally about the middle of March; but it should not on any account be protracted later than the beginning of April. It may, however, be put in much earlier, when the land is in a state of preparation for it, without any danger being apprehended from the season.

*Method of Sowing.*—The most common practice in putting carrot crops into the ground is that of the hand or broadcast method, the seed being dispersed as evenly as possible over the land, after the surface has been reduced to a very fine state of pulverisation by harrowing, in order to provide a suitable bed for it to vegetate in; being then covered in by means of a light harrow. As the seed of the carrot is not of a nature to be deposited with much regularity by the drill, and as the young plants can be easily set out to proper distances in the operation of hoeing, this is probably the best method of putting such sort of seed into the ground, and it is that which is almost



universally adopted in those districts where carrot husbandry is practised to the greatest extent.

But with the view of having the after-culture of the crops more perfectly performed, and at the same time to save the great expense of hand labour in hoeing them, the drill method has been attempted by some, and we believe with tolerable success. The work is finished in equi-distant rows at the distance of from twelve to fifteen or eighteen inches from each other, according to the mode of hoeing that is practised. In this business some cultivators do not make use of drill-machines, but strike the land into small furrows by hoes or other implements contrived for the purpose, and then cast the seed over the ground by the hand, covering it in either by slight harrowing, or hoeing in the tops of the ridglets. In this method, where the drill machine is used, it has been advised by an intelligent cultivator to deposit the seed to the depth of one inch in the rows, leaving the spaces of fourteen inches between them as intervals; the seed in these cases being previously steeped in rain water for twenty-four hours, and left to sprout, after which it is mixed with saw-dust and dry mould, in the proportion of one peck and a half of each to a pound of the seed. The land is afterwards lightly harrowed over once in a place. Two pounds of seed in this mode is found, as has been observed, sufficient for an acre of land.

*After-culture.*—As plants of the carrot kind while young are of a rather delicate nature, and do not rise quickly, it is of great importance to keep them from being too much crowded together, and as free as possible from being shaded by weeds, in their first growth. This may be accomplished by means of very small narrow hand-hoes about three inches in width, with handles not exceeding a foot and a half or two feet in length, the labourers resting upon their knees in making use of them. But as in this way there is considerable danger of too many plants being destroyed, where the workmen are not expert, it may be a better practice to have recourse to hand-weeding, as in this mode the weakest plants may with certainty be removed until the rest are left at their proper distances, and the weeds at the same time be wholly taken away. This operation may be rendered less difficult by having the crops sown on ridges of such breadths as may easily be managed by two or three persons. By this means the business may indeed be performed in nearly as expeditious a manner as by the hoe, the trouble of separating the weeds from the plants in that way being so considerable, and by the operation being performed in this effectual manner at first, there will be less trouble in the future hoeings. A second hoeing should be given in the course of three or four weeks from the first, according to the growth of the crop. This may be executed by means of the common hand-hoe, the operators carefully setting out the plants to their proper distances. These vary in practice from nine to eighteen inches, twelve being that most generally adopted. In the county of Suffolk, where carrot husbandry is carried to a considerable degree of perfection, the most usual distance is fifteen or eighteen inches each way. And at these distances they have found, by long experience, that the crops are finer and the roots larger, than when the



plants are permitted to stand nearer to each other. The tops of the plants by these distances have likewise full room to distend themselves and cover the surface of the soil, by which it is kept perfectly moist and mellow, and consequently in the best state for the nutrition of the plants, as well as for the roots swelling out to their full size. A third hoeing is commonly practised some time in June, according as the growth of the plants or weeds may require. In this, the weeds are to be completely removed; and where the carrot plants stand double or too closely together, the weakest plants are to be cut out, till the whole are left at their limited distances. Further hoeings may occasionally be requisite, of which the cultivator must judge, as it is of the greatest importance in this husbandry to keep the land well stirred and the crops perfectly clean, their goodness materially depending upon such operations being duly performed.

In the drill method the intervals may be cleaned by a small light plough for the purpose or the horse-hoe. Even when executed by the hand-hoe, before the plants appear, as has been practised by some cultivators, it may constitute an advantage in the drill method.

The expense of this business is different, according to the expertness of the persons employed, and the method in which the work is performed. The average expense of different experimenters in various soils and situations, as stated in the *Annals of Agriculture*, is 1*l.* 16*s.* the acre; but in Suffolk, where the culture is familiar, and the work of course executed with much facility and expedition, it only costs from 16*s.* to 18*s.* or a guinea the acre.

It is the practice with many cultivators of this useful vegetable to let the roots remain in the soil during the winter season, to be taken up as they may be occasionally wanted in the feeding of cattle or other animals. But as the crown of the root, by its retaining moisture, is not only extremely liable to rot and decay in these seasons, but the other parts of it from their saccharine quality to be greatly consumed by grubs or other insects below the ground: it is a custom that ought not to be recommended, especially as the crops can be preserved with the greatest ease and safety in any dry situation under cover. The difficulty or impossibility of getting up the roots in many cases of hard frost or deep snow, when they are wanted, also renders the custom highly injudicious and improper. The taking them out of the ground is, therefore, to be constantly advised. The proper period of performing the business is in September or October, when the tops first begin to turn of a yellowish colour, and to lose their freshness. These points should be nicely attended to; as, if the work be delayed too long, much loss will be sustained, in the tops being considerably decreased in bulk, and rendered almost incapable of being consumed by swine or neat cattle; and when performed too early, the roots will not by any means keep so well.

In taking up the crops two methods have been practised; those of raising the roots by means of the plough, and the fork. The first is the most expeditious, but the roots are apt to be much



broken; while by loosening the mould by three-pronged forks of sufficient length, and at the same time drawing up the plants by the tops, they may be raised with great facility, and without sustaining injury. This method, though perhaps rather more expensive, ought in general to be adopted. After being raised from the ground, the roots should be suffered to remain in the field for two or three days, that they may become perfectly dry. With this intention they are sometimes piled up in small heaps or wads. When fully dry, the tops are cut off, and the roots packed up in heaps with dry straw, or, when in small quantities, with dry sand, in some dry close building, a good covering of the former being laid over them. This is the most secure method. But when the crops are extensive, they are sometimes built up in the field or other convenient place, in rows or ridges, at the distance of two feet from each other, tops outwards, with dry straw, to about four feet in height: the intervals being then stuffed, and the tops well covered over by it, sedge or some other similar material being applied by way of thatch. The outsides are also protected by straw, kept close by means of flakes or hurdles. In this mode, which can only be practised in very dry situations, there is a great loss from the tops not being removed and eaten before they were put up. In dry situations they may, however, be well preserved without this trouble or expense, in sheds or other convenient places. But in whatever way they may be preserved, they should not be put up in too large quantities or too closely together, as they are liable to be much injured by heating.

The expense of taking carrots up must vary much with the goodness of the crop, the nature of the land, &c. The average of several trials on different kinds of soil, under different sorts of culture and management, and in different situations, has been calculated at 17s. 8d. the acre. In many cases it will not, however, much exceed half the sum. *Cleaning, topping, and carting*, in the same trials, under similar circumstances, were found on the average to be 15s. 7d. the acre: the whole expense of procuring crops of this kind, in such cases, being in the proportion of six pounds four shillings and eleven-pence the acre; or, in relation to the quantity of produce afforded, about two-pence three farthings the bushel; the quantity of produce, on an average of the whole of the different experiments, being about five hundred and twenty-nine bushels the acre. The expense of cultivating this root on a poor sandy soil, not worth more than five shillings the acre, is stated by the writer of the Report of the State of Agriculture in the County of Suffolk to be two pounds nine shillings and six-pence: the produce in this case being about two hundred bushels on the acre. The first cost, of course, about three-pence the bushel. In medium crops of middling sorts of land the produce may in general be from three hundred to three hundred and fifty bushels on the acre, the expenses of cultivation being from three to four pounds. On comparing them, in these crops, with those of the turnip kind, the difference has been found to be about one pound in favour of the latter.

It is obvious from the above statements, that though the expenses of carrot husbandry are very considerable in most sorts of



land, the largeness of the produce, its utility in the feeding of various kinds of live stock, and the improved condition in which the soil is left by it, warrant its introduction, wherever the cultivator is possessed of those sandy or other descriptions of soil that are suitable for it, as being extremely advantageous.

The consumption of this sort of crop has been chiefly in the feeding of horses, and the keeping of different sorts of cattle, sheep, and hogs; but as, from its firm fleshy nature, and its containing much saccharine matter, it is found to possess the property of quickly rendering animals fat without being employed in very large proportions, its most advantageous application would seem to be in that view. It has indeed been observed, on the authority of experience, that it may be made use of with the greatest profit in the fattening of bullocks. And the experiments of other cultivators have shown, that in fattening other sorts of animals it is equally if not more advantageous. When made use of in this way, the quantity must be proportioned to the size of the animal, a suitable proportion of good hay or cut chaff being employed at the same time. In the early parts of the season, while the root is in its most juicy state, more of this dry food should be given than afterwards, when much of it is dissipated by keeping.

This root is highly relished by all sorts of cattle; store neat stock are found to thrive well upon it; and when given to milch-cows, the quantity of both milk and butter is said to be greatly increased, without their flavour being in any way impaired; but crops of this nature can perhaps only be employed in this way with profit under particular circumstances, as where there is not live stock to be fattened.

In the fattening of sheep, it has been found in some districts to be particularly beneficial, one acre of it being equal to two and a half of turnips. Hogs readily become fat upon this food, when it is prepared by boiling; but when given in a raw state, it has not, in some trials, answered well; though in others the animals have soon been made fat by it.

But the most general consumption of carrot crops has been in the feeding of working horses; in which they have saved much corn, without the animals sustaining any inconvenience. In this application the general daily allowance is from forty to fifty pounds each horse. When joined with cut chaff and a little hay, they are found to keep the animals in proper condition for performing all the different purposes of farming labour. This sort of food is mostly begun to be given them towards Christmas, and continued till the latter end of April. It is supposed by some, that it is better for spring than winter use; they of course give a much smaller proportion at the latter season. This is probably owing only to the root being more fresh and succulent, and of course requiring more dry food to be joined with it.

The value of crops of this nature must be different according to the way in which they are applied in their consumption. The difference has been found to be from two-pence halfpenny to two shillings; but in general it may be from six-pence to eight-pence or



ten-pence the bushel, which on four or five hundred bushels is considerable.

It has been attempted, in order to render the large tops of carrots useful, to convert them into a sort of hay, by mowing them over while green and juicy, without wounding the heads of the roots, and afterwards drying them on the ground. In this way two tons of fodder are said to have been produced from an acre of land. It is obvious, however, from plants of this sort taking in part of their nourishment by their leaves, that if cut while perfectly green, much injury must be done to the growth of the roots. But independent of this, such a method must be uneconomical from the great loss that must be sustained in rendering the tops dry and proper for being put together in stacks. It is a much less wasteful practice to take up such crops gradually, making use of the tops in feeding of hogs, neat cattle, horses, or sheep; all of which are extremely fond of them.

When it is thought necessary to wash the roots before they are made use of in the feeding or fattening of animals, it may be performed with ease and expedition in the same manner as has been recommended for potatoes.

*Parsnips.*—This is another plant of the tap-rooted kind that has been occasionally cultivated, though in a very limited manner, for the purposes of husbandry. The garden parsnip\* is the sort employed in field culture; which when properly cultivated has a long fleshy root, considerably larger than the carrot, and equally sweet, nutritious, and juicy; and, from its being capable of withstanding the severity of the winter season, is probably better adapted to the northern parts of the island. From its easy culture, and the great quantity of food that it affords, it would seem to demand more attention than has hitherto been bestowed upon it by the British farmer.

The soils most suited to this plant are those of the rich, deep, mellow, loamy or sandy kinds, in which the roots can run down to a great depth, and distend themselves with facility. On the gravelly and the pure clayey soils they can never be cultivated to much advantage.

Whatever the nature of the soil may be on which this root is cultivated, it must, in the same manner as for carrots, be broken up to a considerable depth, and have the mould brought into a fine state of pulverisation. In districts where the plant is grown for the purposes of husbandry, there are two different methods pursued: the first is that of ploughing the ground by means of a light plough, which is regulated in the fore part by two wheels being fixed to it, one of which runs in the furrow, and the other on the unploughed land, the former being fourteen or fifteen inches higher than the latter, and which opens down and turns the mould to the depth of about five inches; after which, the furrow is dug down with a spade, so as to form a trench of about sixteen inches in depth, proceeding in the same way till the whole of the field is prepared: but

\* *Pastinaca sativa.*



the latter, which is by means of two ploughs of different kinds, one following in the same track after the other, is by much the most expeditious and economical. The light plough just described answers very well in performing the first part of the operation; but in the second, one of the *trench* kind must be made use of, by which the mould is raised from the bottom of the furrow made by the first, and applied over the slice it had turned up. In this way the soil is not only broken up to a great depth, but the surface left in a fine state of mould. Where this sort of tillage is practised, the work is generally performed in the more dry sorts of land about the middle of February; and in those that are retentive of moisture, towards the latter end of March. The ground, after being thus exposed to the influence of the atmosphere for a week or a fortnight, is harrowed lightly over in order to render it fit for the seed. In some cases, however, a slight ploughing is given to the lands intended for this crop in September, the use of the other ploughs being had recourse to in January in the succeeding year. The principal object in this business is that of loosening and rendering the soil mellow to as great a depth as possible.

The use of manure is not in general so necessary for this crop as many others; but where the land is not in tolerably good heart, it should constantly be employed in such proportions as may be thought sufficient. The well-rotted farm yard dung is in common the best adapted to this crop, being turned into the soil by a light ploughing immediately before the time of putting in the seed.

*Seed.*—Seed for this crop should be collected from the best and most perfect plants, by transplanting, in the manner that has been already directed for other sorts of seed crops; and should always be made use of while perfectly fresh, old seed frequently either wholly failing or coming up with great irregularity.

The proportion of seed that may be employed must be different, according to the nature of the soil, and other circumstances; but in general about four-twelfths of a bushel to the acre may be sufficient. Mr. Young advises five pounds of seed to the same proportion of land.

*Time and Method of Sowing.*—The most usual period of putting this kind of crop into the ground is in the early part of the spring, as soon as the frosts will admit of it; as about the beginning or middle of February. It is, however, sometimes sown in the autumn of the preceding year, immediately after it has been ripened and collected from the plants, as about the beginning of September. It is contended that in this way the plants will appear more early in the following spring; and of course become large and strong before any weeds rise to injure them: and that as the plants are in little or no danger from the severity of the winter season, this is, on the whole, the most eligible period. Where the soil is, however, in a proper state of preparation, as there can be no apprehensions of their being inconvenienced by the growth of weeds, the former may be the most safe and convenient season for the purpose.

The most usual method of sowing the parsnip seed is in broadcast over the land, being afterwards covered in by means of a light har-



row. It is probable that this sort of crop might be sown in rows, either by means of the drill machine, or by having small furrows made in the land and sowing the seed over it in the broadcast method, afterwards lightly harrowing it into them. In this mode, by having the rows at sufficient distances, the crops might be kept more clean and at less expense than in the simple broadcast method.

In districts where parsnips are much cultivated as a field crop, it is the common practice to have beans at the same time with them, either planted in single rows, at the distance of four feet and a half, and about eight or ten inches from each other, or double ones at the distance of twelve feet and eighteen inches in the rows. In this manner two crops are obtained from the same piece of ground; but unless care be taken to remove the beans in good time, great injury may be done to the parsnips. As, though there may have been much leaf and stem before the roots of these plants begin to swell out and acquire their size towards August, the beans ought never to be suffered to remain longer than that period upon the ground. It may, however, be better in many instances, especially where they are cultivated in the drill method, to have only the parsnip crop; as, while the land can be kept equally clean, the roots will probably be much larger in size.

*After-culture.*—Crops of this sort require to be kept perfectly clean and free from weeds during the early part of their growth; frequent hoeing and weeding are, therefore, to be practised. Where cultivated in rows at sufficient distances, the intervals may be cleaned by the plough or horse-hoe. It is sometimes usual, where this sort of crop forms a part of field husbandry, to have recourse to the harrow before the process of hoeing or weeding is begun. This must be performed about the time the seed first begins to germinate; as by harrowing too soon, the weeds will not have risen, and if deferred too long, there will be danger of destroying the buds of the parsnips. This is supposed more necessary on the stiffer sorts of soil, as it renders them more easily weeded. The first weeding may be performed about the beginning or middle of May, according to the forwardness of the plants, being at this operation only partially thinned out where they appear to stand much too close together. The same operation is to be again performed about the beginning of July; when the plants must be carefully set out to the distance of six inches. This sort of work is executed either by means of a small fork with two prongs, or a kind of very small spade having a short handle; the labourer, in making use of it, kneels on one knee, and holding it in his right hand, digs and turns the mould, while with his left he pulls up and removes the weeds. After this second weeding nothing further is found requisite in the parsnip culture.

As this sort of root strikes downwards to a great depth, and of course draws much of its nourishment from below, it may with propriety be introduced after most sorts of fibrous-rooted crops. There is little hazard in the cultivation of parsnip crops, except from the falling of too much rain immediately after sowing, by



which the seed may be in danger of being washed away: or, when dry weather succeeds, from the baking of the land rendering the plants incapable of pushing their roots sufficiently down. They are seldom injured by frosts or other causes during the winter season, or liable to be destroyed by any kind of insects.

The produce of this sort of crop, when cultivated on a proper soil and in a suitable manner, will, from the great size of the roots, be probably equal if not greater than that of carrots.

The application of this root is much the same as that of the carrot. In the fattening of cattle it is found equal if not superior: performing the business with as much expedition; and affording meat of exquisite flavour and a highly juicy quality. The animals eat it with much greediness. It is reckoned that thirty *perches*, where the crop is good, will be sufficient to fatten an ox of three or four years old, when perfectly lean, in the course of three months. They are given in the proportion of about thirty pounds weight, morning, noon, and night; the large ones being slit in three or four pieces, and a little hay supplied in the intervals of these periods.

When given to milch-cows with a little hay in the winter season, the butter is found to be of as fine a colour and as excellent a flavour as when feeding in the best pastures. Indeed, the result of experiment has shown, that not only in neat cattle, but in the fattening of hogs and poultry, the animals become fat much sooner, and are more bulky, than when fed with any other root or vegetable. Besides, the meat is more sweet and delicate.

When chopped and used with dry cut meat, horses are also said to eat them freely and thrive well upon them.

But, besides the root, the tops afford much green food for cattle and hogs, either after being cut off when taken up, or when consumed in the field. In the latter method the proper time of turning the animals upon them is when they first begin to shrink and grow dry.

In order to preserve them for spring use, they may be dug up, in the same manner as carrots, in the close of the autumn, and be packed up in the same way.

As this root is capable of being grown to advantage on soils that are too heavy for the carrot, and possesses equal, if not superior, properties for the feeding and fattening of various kinds of animals, it would seem to require more attention than has hitherto been bestowed upon it by cultivators.

*Mangle Wurzel.*—This is another of the tap-rooted kind of plants that has been introduced into field culture\*. It is probably a variety of the common beet. The plants grow to a large size, both in their roots and tops, the former being of a whitish red colour. The leaves in the latter are of an oblong shape, extremely thick, fleshy, and succulent. They are said to be equal in quality to spinach, and from their frequently extending in length more than thirty inches, and in breadth above twenty, to greatly exceed that vegetable in point of produce.



This, like all the other tap-rooted plants that have been employed for the purposes of husbandry, thrives best in the deep, friable, sandy, or light loamy kinds of soil.

In preparing the ground, it is necessary to render it as deep and fine as possible in the mould. This may be the best effected in the heavier sorts of land, by means of trench ploughing, in the manner that has been recommended for the parsnip; and in those of the lighter kinds by repeated common deep ploughing. In both cases the frequent use of the harrow will likewise be requisite. A proportion of good manure should also be turned in, so as to render the ground sufficiently rich for the perfect growth of the plants. After this, at the time of putting in the seed, the land should be thrown into two-bout ridges, which leaves the tops about two feet in breadth and the furrows one. In this way a considerable increase in the depth of mould is provided for the roots of the plants. And in soils that are in some measure retentive of moisture, the lands are kept by it much drier, and in a state more fit for the growth of the plants.

*Seed, and time of sowing.*—The seed should be carefully selected from such plants as are the most perfect of their kind, and that have been cultivated at a distance from other sorts. It should have arrived at a full state of ripeness, and be made use of while fresh. The proper time for putting the seed into the ground, in the common method of sowing, is in the early part of the spring, as soon as the season will admit, as in the beginning or middle of April; but where the transplanting method is intended, it should be sown much earlier, and very thinly, as the beginning of March, in order that the plants may be in a state to set out early.

*Method of sowing.*—The most common method, where the surface of the land is flat, is to sow thinly over the ground, in the manner that is practised for carrots, covering the seed in by means of very light harrowing. In this way the plants are afterwards set out by the hoe. But where the land is raised into ridges, in the manner just described, another mode is practised; the seed is dropped singly by the hand into little holes made by a dibble to the depth of about half an inch all along the middle of them, at the distance of eight or nine inches from each other, the plants thus standing at the distances of three feet from row to row, and eight or nine apart in them. But as it is not necessary that they should stand nearer than sixteen or eighteen inches, every other plant may be removed, and used for filling up the vacancies where they occur, or if not wanted in that way, wholly removed by the hoe. In this mode the intervals can be kept perfectly clean by the plough or horse-hoe, and the rows by hand-hoeing.

*After-culture.*—All that is necessary in this crop is to set out the plants to proper distances, and keep them clear and free from weeds by one or more hoeings, according to the manner of sowing that may have been practised.

The application of this vegetable has been chiefly in the feeding of neat cattle and hogs; in which both the tops and roots have been employed, but without that success which might have been expected from the manner in which it was brought to the notice of cultivators.



It is probable that, upon the whole, the root has neither been found to be equal in quality as a cattle food, nor to afford the quantity of produce, that was supposed on its first introduction; but, from its being of a hardy nature, and not liable to be injured either by insects or the effects of drought, as well as from its leaves being capable of being repeatedly cut over\*, it may be occasionally cultivated in situations where green food is much wanted in the latter end of the year for milch-cows, or other sorts of live stock. In some trials, the plants seem, however, to have afforded a large produce in leaves, when gathered every two or three days from July till late in September. Others have not found the whole produce in leaves and roots equal to that of the large cabbage on the same kinds of soil, while the culture was considerably more troublesome and expensive, and the crop not so useful for the purpose of winter consumption.

In the trials of an ingenious cultivator, the tops were found to be eat with much greediness by cows, calves, and hogs, when cut green, during the latter part of the summer and in autumn; but the roots were almost wholly rejected at these periods, though in winter, after they had been taken up, they were eaten very well.

The roots frequently rise to the weight of from five to eight or ten pounds, according to the goodness of the land, and may be preserved in the winter by being taken up and packed in the manner that has been recommended for carrots.

The chief objections to this vegetable as a field plant are, the great expense of its culture, its being liable to degenerate, and the fibrous nature of the roots rendering their preparation as cattle food troublesome.

*Lettuces.*—This sort of plants has been lately advised for being cultivated as a good summer food for pig stock, especially sows. There are many different sorts of these plants, but that which is most suitable for this culture is probably the *white coss*, as growing freely and to a large size, and being extremely sweet and nutritious. But many of the other sorts may be grown.

In the preparation of the land for this crop, Mr. Young advises that it should be ploughed before the frosts in winter, turning in about twenty loads of rich well-rotted dung per acre, forming the lands of the right breadths to suit the drill machine and horse-hoes. In February and at the period of sowing, the land should have good scarifyings given it, being well harrowed afterwards.

*Seed, and time of sowing.*—The seed should be such as has been provided fresh from the best plants of the sort that may be made use of. The quantity of seed is mostly about three or four pounds to the acre. The sowings may be performed at different times from the beginning of March to the latter end of April or later, in order to have a proper succession of crops.

*Method of sowing.*—The seed is put in by means of the drill, in equidistant rows at one foot apart, being covered in by means of a light bush or grass harrow.

*After-culture.*—The plants should be afterwards thinned out when

\* Where this practice is adopted, the roots will probably seldom rise to any great size.



they have attained a little growth to the distance of about ten inches in the rows, by means of hand-hoeing, as where this is neglected they are apt to be drawn up weak, and never become good plants. This work may be well done by women. After they are about six inches in height, they may be horse-hoed by means of a scarifier or scuffer, with the hoe four or five inches in breadth. They should also be occasionally hoed; so as to stir and loosen the earth about them afterwards.

It has been recommended by the above cultivator that the farmer should provide proper successions of these vegetables, in order to prevent the great necessity for grains and corn in the feeding of hogs.

Small portions of land may be at first tried, in order to see how the soil answers for this sort of crop.

There can be no doubt of the nutritious properties of this sort of green food, or of its utility for pig stock, as they are extremely fond of it and thrive well upon it.

## SECTION XV.

### *Cultivation of Arable Land.—Plantation Crops.*

**B**ESIDES the various kinds of crops that have been already described, and which serve either for the purpose of human or cattle food, there are several others which are not applicable in these ways, but which are extensively cultivated in different places, in order to be converted into different sorts of manufactures, or for their application in the arts of brewing, dyeing, &c. These, as they require particular modes of culture, and are frequently grown on the same spots of ground for a considerable length of time, may with propriety be termed *plantation crops*.

*Hemp.*---This is a plant of the herbaceous fibrous-rooted kind; which has a thick strong stem, that rises to a considerable height; and affords a rind or covering of a firm strong texture, that is valuable for the purpose of being manufactured into cloth, cordage, &c.

The soils most suited to the culture of this plant are those of the deep black putrid vegetable kind, that are low and rather inclined to moisture, and those of the deep, mellow, loamy, or sandy descriptions. The quantity of produce is generally much greater on the former than on the latter; but it is said to be greatly inferior in quality. It may, however, be grown with success on lands of a less rich and fertile kind, by proper care and attention in their culture and preparation.

In order to render the grounds proper for the reception of the crop, they should be reduced into a fine mellow state of mould, and be perfectly cleared from weeds by repeated ploughing. When it succeeds grain crops, the work is mostly accomplished by three ploughings, and as many harrowings; the first being given imme-



diately after the preceding crop is removed, the second early in the spring, and the last or seed earth just before the seed is to be put in. In the last ploughing, well rotted manure, in the proportion of fifteen or twenty, or good compost in the quantity of twenty-five or thirty-three horse-cart loads, should be turned into the land, as without this it is seldom that good crops can be produced. The surface of the ground being left perfectly flat, and as free from furrows as possible; as by these means the moisture is more effectually retained, and the growth of the plants more fully promoted.

*Seed, and method of sowing.*---It is of much importance in the cultivation of hemp crops that the seed be new and of a good quality, which may in some measure be known by its feeling heavy in the hand, and being of a bright shining colour.

The proportion of seed that is most commonly employed is from two to three bushels, according to the quality of the land; but as the crops are greatly injured by the plants standing too closely together, two bushels or two bushels and a half may be a more advantageous quantity.

As the hemp plant is extremely tender in its early growth, care should be taken not to put the seed into the ground at so early a period as that it may be liable to be injured by the effects of frost, nor to protract the sowing to so late a season as that the quality of the produce may be affected. The best season, on the drier sorts of land, in the southern districts, is probably as soon as possible after the frosts are over in April; and on the same descriptions of soil, in the more northern ones, towards the close of the same month, or early in the ensuing one: but when the ground is more inclined to moisture, it may be a better practice to delay the sowing to a later period in both cases, choosing, if possible, a time when the land is neither too dry nor too moist for performing the business. Sowing as early as possible is, however, in general, to be preferred; as where this is the case, by the crops becoming more strong and vigorous in the early part of their growth, the hemp is found to withstand the various operations that are afterwards to be performed upon it in a better manner.

The most general method of putting crops of this sort into the soil is the broadcast, the seed being dispersed over the surface of the land in as even a manner as possible, and afterwards covered in by means of a very light-harrowing. It is probable, however, that in many cases, especially where the crops are to stand for seed, the drill method in rows at small distances might be had recourse to with advantage; as in this way the early growth of the plants would be more effectually promoted, and the land be kept in a more clean and perfect state of mould, which are circumstances of importance in such crops. In whatever method the seed is put in, care must constantly be taken to keep the birds from it for some time afterwards.

This sort of crop is frequently cultivated on the same piece of ground for a great number of years, without any other kind intervening\*; but in such cases manure must be applied with almost every

\* Mr. Young, in the Agricultural Report of Suffolk, has remarked it to have been grown in succession for seventy years together.



crop in pretty large proportions, to prevent the exhaustion that must otherwise take place. It may be sown after most sorts of grain crops, especially where the land possesses sufficient fertility, and is in a proper state of tillage.

*After-culture.*—As hemp, from its tall growth and thick foliage, soon covers the surface of the land, and prevents the rising of weeds, little attention is necessary after the seed has been put into the ground, especially where the broadcast method of sowing is practised; but when put in by the drill machine, a hoeing or two may be had recourse to with advantage in the early growth of the crop.

In the culture of this plant it is particularly necessary that the same piece of land contains both *male* and *female*, or what is sometimes denominated *fimble*, hemp. The latter kind contains the seed.

When the crop is ripe,—which is known by its becoming of a whitish yellow colour and a few of the leaves beginning to drop from the stems, and is commonly about thirteen or fourteen weeks from the period of its being sown, according as the season may be dry or wet, the first sort being mostly ripe some weeks before the latter,—the next operation is that of taking it from the ground, which is effected by pulling it up by the roots in small parcels at a time, by the hand, taking care to shake off the mould well from them before the handfuls are laid down. In some districts the whole crop is pulled together, without any distinction being made between the different kinds of hemp; while in others it is the practice to separate and pull them at different times, according to their ripeness. The latter is obviously the better practice; as by pulling a large proportion of the crop before it is in a proper state of maturity, the quantity of produce must not only be considerably lessened, but its quality greatly injured, by being rendered less durable. The expense of this operation varies considerably in different districts; in some it amounts to eighteen or twenty shillings, while in others it is equally well performed for eleven or twelve. After being thus pulled it is tied up in small parcels, or what are sometimes provincially termed *baits*.

But where crops of this kind are intended for seeding, they should be suffered to stand till the seed becomes in a perfect state of maturity, which is easily known by the appearance of it on inspection. The stems are then pulled and bound up as in the other case, the bundles being set up in the same manner as grain, until the seed becomes so dry and firm as to shed freely; it is then either immediately threshed out upon large cloths for the purpose in the field, or taken home to have the operation afterwards performed.

The after-management of hemp crops varies greatly in different places where their culture is encouraged; in some it is the practice to only what is called *dew ripen* or *ret* the produce, while in others the general custom is to *water ret* it.

In the former method, the hemp, immediately after being pulled, is carefully spread out in a very even, regular, and thin manner, on a piece of level old pasture, on which it is to remain for five, six, or more weeks, according to circumstances, being occasionally



turned during the time. When the weather is showery, this is mostly done three times in the week; but in other cases twice is commonly sufficient. When the rind or hempy substance becomes easily separable from the woody part or stem, it is taken up and tied into bundles, either to be stacked up on the spot, or carried home and placed in some convenient situation, where it may remain until it can be manufactured. In this process, which is termed *grassing*, great attention is requisite to prevent the texture of the hemp from being injured by its remaining too long on the grass.

But the latter practice is much better and more expeditious, as well as more general. In this the hemp, as soon as pulled, is tied up in small bundles, frequently at both ends. It is then conveyed to pits or ponds of stagnant water about six or eight feet in depth, such as have a clayey soil being in general preferred, and deposited in *beds*, according to their size and depth; the small bundles being laid in both a straight direction and crosswise of each other, so as to bind perfectly together; the whole being loaded with timber or other material, so as to keep the beds of hemp just below the surface of the water: the quantity of an acre, or three small waggon-loads, being in some instances piled in one bed; but as the action of the atmospheric air is essentially necessary to produce that degree of putrefaction which is requisite for destroying the small fibres and vegetable gluten by which the bark or hempy substance adheres to the *bun* or stem, it may be more advantageous to build them in much smaller beds, as by such means the business may not only be more expeditiously accomplished, but the danger of rotting the hemp too much prevented. And on the same principle the depth of the ponds should not exceed the dimensions given above. It is not usual to water more than four or five times in the same pit, till it has been filled with fresh water. Where the ponds are not sufficiently large to contain the whole of the produce at once, it is the practice to pull the hemp only as it can be admitted into them, it being thought disadvantageous to leave the hemp upon the ground after being pulled. It is left in these pits four, five, or six days, or even more, according to the warmth of the season, and the judgment of the operator, on his examining whether the hempy material readily separates from the reed or stem; and then taken up and conveyed to a pasture field which is clean and even, the bundles being loosened and spread out thinly stem by stem, turning it every second or third day especially in damp weather, to prevent its being injured by worms or other insects. It should remain in this situation for two, three, four or more weeks, according to circumstances, and be then collected together when in a perfectly dry state, tied up into large bundles, and placed in some secure building until an opportunity is afforded for breaking it in order to separate the hemp. By this means the process of *grassing* is not only shortened, but the more expensive ones of breaking, scutching, and bleaching the yarn, rendered less violent and troublesome. Besides, the hemp managed in this way sells much dearer than that in the former method. After the hemp has been removed from the field, and the business of *grassing* properly performed, it is in a state to be broken and spun.



gled ; operations that are mostly performed by common labourers, by means of machinery for the purpose, the produce being tied up in stones. The refuse collected in the latter processes is denominated *sbeaves*, and is in some districts employed for the purposes of fuel, being sold at two pence the stone. After having undergone these different operations, it is ready for the purposes of the manufacturer.

The produce of hemp crops is extremely variable and uncertain. In Suffolk it sometimes rises to forty-five and fifty, or even more, stones on the acre ; but in other cases it does not much exceed half these quantities. The average of crops of this sort, when made ready for the *beckle*, is stated by a late writer to be from thirty-eight to forty stones of fourteen pounds each. The price is generally from about seven shillings and six-pence to eight or nine shillings the stone, exclusive of the bounty allowed by government, which often amounts to fifteen or twenty shillings the acre more. When sold on the ground as the crop stands, it generally fetches in Suffolk about one shilling the rod, or eight pounds the acre.

In cases where the hemp stands for seed, the most common proportion is from about eleven to twelve bushels on the acre, the price being from four or five to six shillings the bushel.

The expenses of cultivating and managing the different operations in crops of the hemp kind, from their requiring the best sorts of soil, much manure, and great attention and trouble, must of necessity be considerable. From the statements of the able writer of the Survey of the County of Suffolk, they however appear highly beneficial to the cultivator. But it is obvious that they must be liable to vary greatly according to circumstances. At Hoxne the expenses per acre were, 9*l.* 8*s.* 10*d.*, the produce 16*l.* 17*s.* 6*d.*, and the profit 7*l.* 8*s.* 4*d.* ; while at Beccles where calculated differently ; and rent *valued*, the expenses were 14*l.* 11*s.*, produce 20*l.*, and the profit 5*l.* 9*s.* But though the profit on hemp may appear considerable, the cultivation has not increased in any very rapid manner ; which is probably owing to its requiring a larger proportion of manure than can commonly be spared from the other sorts of crops, as well as its demanding a great and constant attention through the whole of its management, which frequently interferes with the other operations of the farmer. In districts where its culture is the most extended, it would seem, however, to be of great utility and advantage to the poor, by affording them much employment in the different processes and manipulations through which it is necessary for it to pass before it becomes in a state fit for the manufacturer.

When hemp crops stand for the purpose of procuring the seed, they should remain upon the ground till perfectly ripe ; when, after being pulled, the produce should be placed thinly upon its root end against a wall, paling, or other convenient situation, according to the state of the weather, until it becomes quite dry : the top parts containing the seed are then cut off, the seed being threshed out immediately and cleaned ; as when it is suffered to remain any length of time in its moist uncleaned state, its colour is liable to be much



injured, and the substance so much impaired as not only to be improper for the purpose of sowing, but on being crushed for oil to afford a less quantity, and such as is of an inferior quality. The buns or stems of the hemp may afterwards either be put into the pond to be *watered*, or *dew retted* in the manner described above: the former practice is, however, in general to be preferred; as where the latter is adopted the hempy substance seldom becomes of so good a colour.

According to a late writer the most advantageous period for the farmer to dispose of hemp crops, is while they remain upon the ground, just before the season of pulling them; as by this means he avoids the trouble and uncertain expense of the different operations which are requisite in its preparation for the market, and which are so liable to interrupt his other business. In cheap populous districts, where the soil is suitable, and there is a large extent of grass or other sorts of green crops in proportion to the arable, hemp crops may probably be introduced and cultivated to great profit by the attentive farmer; but while the demand for grain continues so great, it is not very likely that its culture should become extensive in other situations.

As hemp, from its growing to a great height and being very shady in the leaf, leaves the land in a perfectly clean condition, it may, where the soils are proper, be an excellent preparation for wheat crops; and where they are too light for that sort of grain, barley or turnips may be had recourse to with advantage.

The hemp produced in this kingdom is in general considered as superior to that imported from abroad, and of course more proper for being converted into the various finer sorts of cloths and cordage.

*Flax.*—This is another plant of the fibrous-rooted kind, cultivated in the field, for the purpose of the cortical substance covering the stem of the seed. It is the common flax plant that is employed in this culture, which rises in stem to the height of from two to three feet.

The soils most suitable for crops of this sort are those of the more deep and friable loamy kinds, and such as contain a large proportion of vegetable mould in their composition. On strong loamy clays that have been well broken down and reduced by tillage, they have also been found to answer well. The sandy or very light gravelly lands are seldom found to succeed well with flax crops. But whatever the nature of the soil may be, it should neither contain too large a proportion of moisture, nor be too dry; but have the mould in a fine and well pulverised condition. Such lands as are situated rather low, as upon the banks of rivers, are found by cultivators to be well adapted to the growth of flax. It has indeed been contended by some, that where the soil contains water at no great depth below the surface, it is the most beneficial for the growth of this crop; as in those parts of Holland and the Low-countries where it is grown in the greatest perfection, the ground is always found to be deep, and rather inclined to stiffness and the retention of moisture at some depth below the surface. The lands for this crop should neither be



in too rich nor too poor a condition; as when the former is the case the flax is apt to grow too luxuriantly, and of course to produce a *coarse* sort; and on the contrary, where they are in the latter situation, the plant by growing weakly affords only a small produce.

In the preparation of the land, as it is necessary that it should be made perfectly fine in the mould, it must be repeatedly ploughed over, and broken down by harrowing. When the land is to be broken up from the state of sward, the first ploughing should be given late in the autumn, and be left in that condition till the beginning of the succeeding year; when it should be well reduced by harrowing with a pretty heavy harrow, and afterwards, in the course of a week or two, ploughed over a second time, in which situation it may be left till the period of putting in the seed, when it ought to be again harrowed over by a lighter harrow, and ploughed with a very light furrow: but where flax is sown after grain or other sorts of crops that keep the land in a clean state, the first ploughing need not be given until the beginning of the year, in which state it may remain till it becomes tolerably dry in the early spring, when it must be well broken down by harrowing and rolling, and after it has continued in that situation for eight or ten days or more, according to circumstances, the land will be ready for the seed, or, if not perfectly fine, another light ploughing and harrowing may be given previous to the putting in of the seed.

Flax crops are cultivated after most sorts of grain, as wheat, rye, and oats, as well as after different kinds of green crops, as turnips, potatoes, and several others, but when put in after the latter the flax in general succeeds the best.

*Seed.*—That which is fresh and sufficiently ripened should constantly be preferred; which is known by its being more bright and shining in its colour, more oily in the feel, and more weighty in the hand. Seed of home produce is sometimes made use of for sowing; but more generally that which is imported from other countries, as Holland, the Baltic, and America; that brought from the first is, however, mostly held in the highest estimation, from its quality of ripening more early than the others, and affording a more abundant produce of that sort of flax which is most useful in the different manufactures; that brought from the Baltic is supposed to produce a coarser sort of flax, but a larger proportion of seed, than any of the other kinds. The American seed yields in general a flax sufficiently fine; but the seed pods being small, there is not so large a quantity of seed obtained from it. In Yorkshire they frequently sow the seed of home produce for white flax; but where seed is intended to be taken, the Baltic sort is preferred, which, for the succeeding and a year or two afterwards, is found to answer well as white flax. And in the northern parts of the kingdom it is often a practice to sow seed obtained from the crop of the preceding year, especially where it was raised from imported seed. It is supposed by the cultivators of this sort of crop, that their success in raising it depends greatly on the seed being frequently changed, and such as is imported from abroad being made



use of. It is probable, however, that if that selected from the finest and most perfectly ripened seed of our own growth was employed, it would be equally productive both in the flaxy substance and the quantity of seed, and at the same time afford the former of an equally good quality for all the purposes of the manufacturer. In Ireland they prefer the American seed for their lighter and more elevated grounds, and the Dutch or Baltic for those of the more heavy kind.

*Quantity of Seed.*—The proportion of seed is variable according to the circumstances of the soil, the uses to which the produce is to be applied, and the method of sowing that is practised; but in general from two bushels to two and a half may be considered as sufficient for the acre, when sown in the broadcast manner. It should never be sown very thick, except where the flax is required to be very fine in quality. For, when the seed is sown too thick, the plants, from being so close together, are liable to be drawn up to a great height and become weak, consequently to fall down upon the ground in case of much wet weather, and the produce be thereby greatly injured in its colour and other properties. But in the drill mode of sowing, a much less proportion of seed will be found sufficient. If the distance of the rows be eighteen or twenty inches, less than one half of the above quantity will answer the purpose of the cultivator.

In short, where the crop is intended to stand for seed, in whatever manner the sowing is performed, a much less proportion of seed should be employed than where the flax is the chief object.

*Time and Method of Sowing.*—The period of putting flax crops into the ground is different, according to the situation and nature of the soil; but from the beginning of March to the middle of April may in general be considered as the most proper season. In Yorkshire, when this crop is cultivated upon land broken up from the state of grass, the seed is mostly sown before the second week in April, if the weather will admit of it; and on such lands as have been in the state of tillage, the period of sowing is seldom protracted more than a week or ten days longer. Early sowing, where it can be safely adopted, has the advantage of enabling the flax plants to cover the ground well before they can sustain much injury from those of the weed kind, or from the effects of the dry hot summer season.

The broadcast method of sowing is that which is the most generally employed in putting crops of this sort into the ground, especially where they are intended only for the purpose of flax; but where the seed is the chief object, they are sometimes put in in the drill method; and it is contended by some that in this way better seed may be produced, than by the former mode; as where the seed is sown thickly the plants run up more in height, and produce a flaxy substance which is of an extremely fine and soft quality; but the seed, from the weakness of the plants, is small in the grain, and not large in quantity; while, on the contrary, when sown thinly the stems of the plants, not rising so high, are more strong and



vigorous, sending off more numerous branches towards the top, by which not only a greater abundance of seed is afforded, but such as is much better filled, and more plump and heavy.

In sowing the crop in the first method, much care is necessary in the seedsman to distribute the seed over the surface of the land in as regular and uniform a manner as possible, as without this care the crop will sustain great injury by coming up too closely together and in tufts. It is afterwards to be harrowed in by one or two light harrowings in a place; or, where the surface of the ground has been rendered very fine and even, a bush-harrow may answer the purpose equally well. The seed should not in either way be covered in too deeply, as the quick vegetation of the crop may by such means be too much retarded.

Where the drill is employed, the distances of the rows may vary according to the circumstances of the soil, or the intentions of the cultivator; but when the crop is to be kept clean by the hand-hoe, small intervals, as twelve inches, are mostly recommended; but where horse-hoes or cultivators are to be made use of, intervals of eighteen or twenty inches, or perhaps more, may be proper, care being taken that the machine does not deposit the seed to too great a depth in the soil. After the operation has been performed, a bush-harrow, or light harrow of the common kind, may be once passed over the surface just to render it even. When the soil is of a dry kind, and the season is inclined to be dry, in either method of sowing it may be advisable to pass a light roller over the ground immediately after the seed has been put in, in order that the moisture may be more effectually preserved.

*After-culture.*—Although it is seldom the practice of the cultivators of flax crops to weed them, especially when sown in the broadcast method, yet as the plants are extremely tender in their early growth, and of course liable to be much injured and retarded in their vegetation by the rising of weeds, a hand-hoeing or weeding should constantly be given them, as soon as the plants are fully come up and show themselves. This is particularly necessary where proper attention has not been bestowed in cleaning and preparing the ground by repeated ploughing, harrowing, and carrying off or burning the weedy materials. In performing the business of weeding great care should be taken that no injury be done by cutting up or treading under foot the flax plants. It is perhaps only by keeping the land perfectly clean and free from weeds in this way, during the early growth of the plants, that good crops of this kind can be produced.

It is recommended that this operation should be performed as soon as the flax plants have advanced three or four inches in height, the weeds that are drawn out being carefully picked up and conveyed from the land. By having the soil well prepared before the seed is put in, much expense in this way may, however, be avoided.

In the drill method of sowing, where narrow intervals are preferred, the crop is mostly kept clean by the use of the hand-hoe; but where the distances of the rows are larger, a small plough, the



horse-hoe, or what is termed a cultivator, may be made use of in order to preserve the land in a perfectly clean condition. A sort of triangular harrow has also been found to be a very convenient tool for this purpose. From its having handles behind, it is capable of being guided with facility, and at the same time made to pass deeper or shallower, according to circumstances, without the danger of raising the mould against the rows of the plants. In this way the business may be accomplished by one horse at but little expense, much ground being gone over in a small space of time. In these cases, however, the rows must be cleaned by means of hand-weeding, which is accomplished with much less difficulty and harm to the crops, from the room that is afforded by the intervals.

No other sort of plant should ever be grown with that of flax, though such methods may have been in some instances practised, as the crops in such cases must always be in danger of being greatly injured.

The young flax plants are sometimes liable to be destroyed or greatly injured in their growth by the attacks of insects; where this is the case, it has been found useful to sow soot or wood ashes thinly over the crops, as from the vegetation of the plants being in this way promoted, they become improper for the food of such animals.

As crops of this kind, from the tallness of their growth, are apt to fall down and lodge upon the ground, by which the flaxy substance is liable to be injured in its colour and other properties, it has been proposed to support and keep them up by means of long slender poles, or small cords, passed in different directions of the ground, and fixed at the angles by stakes. These methods are, however, troublesome; and when the crops are not sown too thick, will seldom or ever be necessary.

The cultivators of flax crops are not yet fully decided in respect to the degree of ripeness at which they may be pulled with the greatest benefit; some contending that it ought to be done before the greenness of the stems wholly disappears, in order that the fibres of the flax may be finer and have a greater degree of softness. Others with similar intentions maintain, that it should be pulled before the seeds are perfectly formed; while others again insist that the operation should not be performed until some of the capsules containing the seed begin to open, asserting that the fibres of green flax are not only tender but run too much to tow. But, notwithstanding this, experience has shown that the fibres of over-ripened flax are constantly harsh, and possess too great a degree of stiffness; and besides, separate from the reed with more difficulty, and are more tedious in the operation of bleaching. Hence it would seem that both extremes ought to be carefully avoided, and that the most proper period for accomplishing the business is immediately on the stem or reed beginning to change from green to a yellowish cast, and the lower leaves to fall off, the seed assuming a brownish colour.

Where the seed is the principal object of the grower, the crop should, however, be suffered to remain upon the ground until it



becomes perfectly ripened, which is easily known by the seed-pods turning hard and sharp in the points, and the capsules beginning to crack and open. This generally happens towards the latter end of July or beginning of August.

In pulling, the flax is laid in small parcels or *beats* upon the surface of the ground, in such a position as that it may have the full benefit of the sun. It is then to be tied up, and conveyed as soon as possible to the place of watering. As where this sort of crop is cultivated upon a large scale, from the great difference in the soil and other causes, there will be considerable variations in the quality of the flax, some being fine, others coarse; some long, and others short; care should be taken at the time of pulling to separate and put the different sorts together; as by this means the injuries sustained by subjecting flax of such different qualities to the same operations and processes may be avoided. It has been remarked by an intelligent writer, that inattention in flax cultivators to this necessary precaution, is the chief cause why crops of this kind often turn out of so little value, and the principal reason of the smallness of the proportion of such flax as is of a good quality in comparison with that of the tow or inferior sort: the different manufacturers, in the course of their operations, being under the necessity, on account of the mixed condition in which they receive it from the cultivators, to reduce the quality of the whole to a much lower degree than would be requisite if the different kinds were sorted at the time of pulling the crops, and delivered under such circumstances.

When the seed is intended to be saved, it is the usual practice in pulling the crop to place the handfuls partly across each other, as by this means the business of *rippling* is greatly facilitated, the operators not having the trouble of separating them from the large bundles.

The operation of *rippling* should be performed as soon as possible after the crops have been pulled. This is accomplished by means of a sort of iron comb with strong triangular teeth of considerable length, set upright, pretty closely together, and fixed upon a strong flat piece of wood, so as that the operators can sit at each end, and by frequently striking the seed-end of the flax upon it, and pulling it through with rapidity, the seed-pods are forced off with much expedition, and in a very perfect manner. Where the seed thus obtained is intended to be preserved, a large cloth should be spread out previously in some convenient situation for the purpose of receiving it from the ripple, and it should be immediately afterwards spread out thinly, and exposed to the sun, till the capsules containing it become perfectly crisp and dry; they are then to be broken and the seed separated from them by lightly threshing or treading upon them; the whole of which being afterwards well cleaned by winnowing and sifting, and laid up in a dry room. And when a large quantity is put together, it should at first be frequently turned over in order to prevent its being injured by heating. The seed which is procured from such crops as are intended for flax, and which have not stood till it is perfectly ripened, may be collected



and sold for the purpose of having the oil expressed from it; but it is improper for use as seed.

Some experienced cultivators of flax, when grown for seed, set up the produce, when tied into sheaves, in the manner of grain, and when it is become perfectly dry, have it stacked up until the ensuing spring; when, by placing the tops of the sheaves towards each other, and making use of a roller, the seed is easily forced out. In this way more time is supposed to be allowed for the after-management. In most districts where much attention is bestowed, it is likewise the practice, even when the crops are only cultivated for the purpose of the flax, to ripple off the seed pods before the business of watering is commenced; as it is found from experience, that when it is put into the water without this having been done, the water, from its quickly becoming putrid, is liable to do much injury to the flax.

The stem parts are tied up into small parcels containing two or three handfuls, in a rather loose manner, in order to their being carried to the pond for the purpose of *watering*, which is the next operation that becomes necessary.

The intention of this process is that of inducing a slight degree of putrefaction, by which the substance that unites the flaxy material to the stem or reed is destroyed, and the flax of course rendered easily separable. In this crop, as in that of hemp, there are two methods practised for the purpose of accomplishing the business; one of which is immersing it in ponds of stagnant water for some time, and the other by exposing it to the influence of the atmosphere till the same circumstance takes place. The former is the most general practice, and commonly esteemed more certain as well as more safe from injuring the flax; the exact point of putrefaction that is requisite not being so easily ascertained in the latter method. Whichever practice is adopted, the length of time which is required for accomplishing the purpose, depends considerably upon the state of ripeness at which the crop has been pulled, the quality and temperature of the water in which it is placed, and the moisture or dryness and warmth of the season in which it is exposed.

In *water-retting* the flax, ponds of stagnant soft clear water are constantly preferred, as being found much superior to those of other kinds. The greater the degree of warmth the water has attained before the flax is immersed in it, the sooner the process is effected, the heat of the water greatly promoting the perfect separation of the harl or flaxy material from the reed. The rule for judging when the flax has undergone a sufficient degree of maceration in the water, is that of the cuticle or skin readily peeling off from the bun or stalk the whole length; the latter breaking as if rotten, and appearing of a deep yellow colour.

The manner of depositing the flax in the water is much the same as that already described for hemp: in some cases, however, instead of the small bundles of flax being placed crossways over each other, they are set in an erect position, the tops of every layer except the lowest being upwards. And instead of keeping the whole down below the surface of the water by stones, wood, or other heavy mate-



rials, earth is made use of, to the depth of a few inches, and men employed to tread the whole down occasionally once or twice a-day at first, so as to keep it from rising above the surface; as when that happens, the flax becomes black and the sale is injured. The first seems, however, the most simple and easy method.

After having thus remained in the water a proper length of time, as five, six, or more days, according to the particular circumstances of the case, the flax is taken from the pits by means of drags, and laid on the sides perfectly straight for a few hours, in order that it may become somewhat dry; it is then removed to a pasture or grass field that has been lately mown, where it is to be spread out thinly in rows in as even and regular a manner as possible, each row overlapping the other a few inches, in order the better to prevent their being disturbed by the wind. When left in lumps and not spread evenly, the flax is liable to become green, and never afterwards to be capable of being made a good colour.

After having remained in this situation for a few days, it should be turned, which is best done after a shower or two of rain. When the colour is become perfectly bright and even, and the cuticle or skin begins to rise, blister, and separate from the stem or reed, it is ready to be taken up. For this business a fine dry day should be chosen, if possible; and the flax, after being bound into pretty large bundles, may either be stacked up for use afterwards, or be immediately broken and scutched in the manner already advised for hemp.

In the second or *dew-retting* method, which is much practised in some of the southern districts of the kingdom, as in Dorsetshire, the flax, immediately after being pulled, is spread out in rows thinly upon a grass field, where it is occasionally turned until the process of putrefaction has, in a more slow and gradual manner than in the above practice, affected the condition which is necessary for the easy and perfect separation of the flaxy material from the reed or stem. But in this mode there is considerably more danger, from the flax being under the necessity of remaining a much greater length of time exposed to the action and effects of the weather and other causes. But in whichever method the flaxy material is brought into the proper condition for being separated from the reed or stem, great care should be taken that it be not damaged by continuing too long upon the grass, as in many cases, especially in rainy seasons, the under side next the grass is liable to be rotten or greatly tendered, before the upper one is nearly in a suitable state of preparation. The supposition that exposure in the field tends to expedite the process of bleaching in the manufactured article is not well founded; in practice no cloth being found to bleach with so much expedition, or in so uniform a manner, as that made from such flax as has been water-retted in a complete and equal manner.

Before the business of *breaking* or *scutching* the flax can be performed, which is the next operation that it undergoes, it becomes necessary either to expose it to the heat of the sun, by placing it against a wall or paling in a slanting position; or the effects of fire, by putting it over hurdles, or, what is much better, placing it in an oven heated by means of the refuse of the flax. In either case the



fire should be applied in such a manner as that the heat may be very moderate. The flax should only be permitted to remain such a length of time as may be just sufficient to remove any damp it may have acquired. In these ways the dampness is dispelled in a more equal and safe manner than by any other method except that of the sun, which is always to be preferred when possible.

In regard to produce, there is scarcely any crop that varies more considerably than that of flax, either in the quantity or quality of the article. From twenty to sixty or seventy stones of fourteen pounds each have been obtained from an acre of land, according to circumstances; but from forty to fifty stones may be reckoned a medium crop. The expense incurred in the cultivation and after-management of this sort of crop is very considerable, arising from eight to ten or twelve pounds an acre on the average, where the object of the grower is the flax. When these crops are disposed of before pulling, which is the practice of different northern districts where the culture of flax is extensive, the price is in general from about six or seven to ten pounds, or upon the average something more than seven pounds.

When flax seed is the aim of the cultivator, the quantity of that sort of produce is generally from about six to ten or twelve bushels on the acre. The price depends upon various circumstances, as the quantity of foreign seed that is imported, the demand there is for it for the purposes of being expressed for its oil, or for being formed into a sort of jelly as food for fattening cattle. It is mostly about half the price of that which is imported from Holland for the purpose of sowing. On the average it may be probably estimated at from about three or four to five or six shillings the bushel.

It seems probable from these statements, that flax may be grown with great profit and advantage in many situations, as in grass districts, where labourers can be easily procured to perform the different operations it requires about the harvest season, where the produce of grain crops more than supplies the demands of the inhabitants, and where there are means of providing due supplies of manure. But under other circumstances, as from the fibrous nature of its root, the size of its stem, the smallness of its leaf, and the quantity of seed which it affords, it cannot but exhaust and impoverish the land without returning any thing in the way of manure, it should perhaps seldom be had recourse to.

The cakes produced in the process of expressing the oil from flax-seed are made use of for the purpose of fattening cattle with great success, and in consequence the price has of late been unusually high.

A mucilaginous or jelly-like substance is also prepared from flax-seed, by means of boiling, or the pouring of water in a boiling state over the seed when crushed, which is much employed in the fattening of live stock.

*Hops.*—The hop is a plant of the fibrous-rooted perennial kind, which climbs to a considerable height, under the support of poles. There is only one species of this plant in cultivation, but which has several varieties, as the *red-bind*, the *green-bind*, the *white-bind*, &c. It is chiefly grown for the sake of the bud and flower, which are em-



ployed in the brewing of beer and other malt liquors for the purpose of imparting an agreeable bitter to them.

The first of the above varieties affords a very small hop ; but, from its hardy nature, is capable of being cultivated in exposed situations, and where the climate is cold and not adapted to the other sorts. It is said to possess the property of resisting the *blast* more effectually than any of the other varieties, often appearing healthy and vigorous, in seasons when the other kinds are greatly infested with flies and lice ; and at the period of picking to be less exposed to injury from the effects of the sun or rain than those of other sorts.

The second or *green-bind*, though less hardy than the preceding kind, is considerably more productive, and on the middling descriptions of land, in situations that are not too much exposed, often succeeds very well.

But the third or *white-bind*, which is still more delicate and tender, is the most in estimation, on account of its being more early, and the produce selling at a much higher price. In hops there are also male and female plants ; but the latter only afford the produce for which they are cultivated ; the former should of course be extirpated as improper and useless.

It is obvious, that as these different varieties must of necessity suit different sorts of soil, and become ripe at very different periods, the planter should be cautious that plants of the different kinds are not set out in the same plantation ; as when this point is wholly neglected, or not sufficiently attended to, there is much inconvenience experienced in the after-management of the crops, especially where they are large, from the difficulty of procuring a sufficient number of labourers to proceed with the business in so expeditious a manner as may be requisite for their safety ; while by planting the separate sorts together in a detached manner, the business of securing and preserving the produce may be accomplished with greater convenience, as the crops become ready at different periods.

The most proper situations for plantations of this kind are those that have an easy, natural, sloping position towards the south, or which are more level, and possess the advantage of a south-westerly exposure, and which are well protected and sheltered from the effects of the north and north-easterly winds, by high grounds, tall fences, or trees of the forest kinds, rising at some distance from them. But, as the plants grow closely together, and rise to a considerable height in the stems, they should not by any means be confined, or too much closed up in the plantations themselves. but have the benefit of a full and perfectly free admission and circulation of air, as well as light and the influence of the sun ; as these have not only the effect of promoting the vigour and healthy growth of the binds, but, by quickly dissipating and drying up the superabundant moisture that may rest upon them, prevent the crops from being so much injured by the *blast* or *mildew*. This is fully shewn by the circumstance of the middle or more close parts of such crops, especially where they are extensive, being greatly injured in this way, while the outside parts, that have the advantage of being more fully exposed to the air, sustain no injury at all in these respects.



It has been remarked by a late writer, that such situations as are in the immediate vicinity of the sea, or near marshy and fenny levels, seldom answer for the culture of the hop-plant, as they almost invariably miscarry in bad seasons.

The soils most adapted to the culture of the hop-plant are those of the more deep, strong kinds, whether of the loamy, clayey, or sandy qualities. They should be such as incline to dryness, without being too deficient of moisture, and that have a considerable depth of good, rich, vegetable mould. The thin, gravelly and chalk soils are wholly improper for the growth of plants of this nature; the former not being sufficiently retentive of moisture for the vigorous growth of the plants; and the latter, from its absorbent quality, imparts its humidity to the roots of the binds in too scanty a proportion for the healthy support of their luxuriant vegetation.

There is, however, a sort of thin slatey soil, intermixed with good rich mould, which has an under stratum of stone, that is found, by experience, to be admirably suited to the growth of the hop-plant, and on which it often rises to its fullest height and luxuriance, producing an equally abundant produce with those of the most deep, strong, and fertile kinds. Hops are extensively cultivated on a soil of this description in the vicinity of Maidstone in Kent.

Hops may be cultivated on such lands as have been in a state of tillage; but in these cases it is absolutely necessary that a sufficient proportion of manure be applied, to bring them into a proper state of fertility for the perfect support of the plants. Such land as has been long in a state of pasture, and which has, in consequence, accumulated a large proportion of vegetable matter, as that of old orchards, rich dry meadows, or other grass land, is however the most proper for the purpose.

In either case the ground should be reduced to a perfectly fine state of mould, by repeated ploughing and harrowing, or digging it over with the spade. This last is the most effectual method where the land is to be broken up from the state of sward, and should be performed in the autumn, in order that it may have the advantage of the effects of the frosts during the winter season. By these means the plantations are not only to be brought into a perfect state of pulverisation, but also rendered clean, and free from all sorts of weeds. In the last operations, the ground should always be left in as even and level a situation as possible, if it be sufficiently dry; but where it is inclined to the retention of moisture, it may be ridged, in order more effectually to remove the superabundant wetness. And immediately before the season of planting, a quantity of compost, formed from well rotted dung and good fresh vegetable earth, by being intimately blended together, and remaining in that state for a considerable length of time, should be applied in small heaps, so as to afford about half a bushel for each hole.

The business of planting out the sets is then to be commenced, which is performed at different times, according to the nature of the plants. Where sets from the cuttings of old binds are made use of, the work is best performed in the latter end of February, in March, or the beginning of April, as the season may suit; as these are the



periods of cutting over and dressing the old binds, when sets of this sort can be the most easily obtained; but, when bedded, or root sets are employed, as may sometimes be the case on digging up former plantations, the autumn is the most proper season, as about the end of October, or beginning of November.

In the first of these methods the sets or cuttings should be made from the most healthy and vigorous binds, each being cut to the length of about five or six inches, having two or three eyes or joints, which are the buds, from which the roots and stems, or new binds, proceed. They are sold by the hundred of six score, at from sixpence to a shilling. In the planting, different forms and distances are preferred by different planters, according to the manner in which the after-culture of the crop is performed. Where it is executed by means of horse labour, the best method is that of setting them out in rows, at suitable distances, so as to form straight lines in every direction. But, in cases where it is to be executed by the hand, this is not of so much consequence, provided a sufficient space be allowed for the healthy growth of the plants. In this way some practise the row method, while others prefer a triangular plant. It is evident, however, that the planting in equidistant rows, so as to admit of the ground between the plants being kept clean by the harrow and nidget, must be much less expensive than that of the irregular mode, in which hand labour must be employed.

The distances at which the plants are set out, or rather those of the holes and hills formed for their reception, are different according to circumstances. Some cultivators advise six feet and a half or seven feet, while others prefer a five or six feet plant. As the hop plant, from the luxuriance of its growth, rises to a great height, and sends forth much bind and foliage, it must of necessity require considerable space, as where the plants stand too closely together they are not only more liable to become diseased, but to *house* or run together above the poles, by which so much shade is produced, as to prevent the hops below from completing their growth; and of course the quantity of produce is much lessened.

On these grounds it would appear that this plant cannot be cultivated with perfect success in less space than from six to seven feet: on good rich soils the latter distance may be the most advisable, as the plants will be more at liberty to effect their full growth. In this way there will be a distance of from eight to nine feet from the centre of the hills.

The holes are set out in different ways, according to the particular custom or practice of the cultivators; some making use of a line, in which knots are formed at the distances intended, which is extended the whole length of the plantation, small sticks being then thrust down at the knots, and the land measured off from these by sticks of a proper length; others mark the holes off at once by means of stakes drove down into the ground at suitable distances each way: but a more expeditious method than either of the above is that of striking furrows by the plough in different directions of the plantations, at proper distances, so as to form a sort of squares, the holes being made in the angles where the furrows cross each other.



In making the pits or holes, the earth is taken out by a spade or *spud*, to the depth of about twelve inches in a circular form, having the diameter of about eighteen inches, the bottom mould being a little stirred. These are then partially filled with the earthy compost mentioned above; and the mould that was taken away replaced upon it so as to make a little rising or hillock. On these hillocks seven sets or roots are mostly planted by means of a dibble, one in the middle or top of the hill, and the others around it, at equal distances, about four or five inches from the sides of the holes. The sets are generally put in to the depth of about two inches in the compost, and so as to have the tops wholly covered by the mould on the surface of the hills. Some planters, however, prefer covering them lightly with the fine earth taken from the holes, after they have been planted out in the compost, to the depth of an inch and a half or two inches.

Nothing further is now necessary till about the middle of May, except keeping the ground about the plants free from weeds; when, from the increasing growth of the young plants, it will be proper to apply an addition of fine mould about them on the hills, which may be scraped up from the intervals. And in order to check the growth of the young shoots, and thereby increase the vigour of the roots, some twist them together into a sort of knot. Others, however, advise that two small sticks, about a couple of yards in length, be set in each hill in order to direct the climbing of the shoots, three or more being led up each stick, and tied occasionally during the summer with bass or sedge. A second moulding up will be required about the latter end of July or beginning of August, which is to be performed in the same manner as before.

There is still another mode of planting practised in some districts where the land is of the boggy kind and much inclined to moisture. This is that of forming the plantations into a sort of beds about sixteen feet in width, by digging out trenches three feet in width, and from two to two and a half in depth, spreading the earth thus removed evenly over the beds previously prepared. On these the sets are put in, after the holes are made a spit in depth, twelve inches in diameter, and six feet apart in each direction, so as to admit three rows on each bed, in the same manner as in the other methods. The plants in this mode are poled in the course of about three weeks with old short poles, to each of which two or more of the binds are tied; the land being afterwards kept in order by hoeing and raking. The operation of hilling is performed in the latter end of June or beginning of July. This appears, however, a tedious and expensive plan without its possessing any superiority except that of rendering the lands somewhat more dry.

It is the custom with some planters to cultivate other sorts of crops at the same time with the hops, as common beans, cabbages, French beans, and onions; but this is a practice by no means to be recommended, as much injury may be done by their crowding the plants, and preventing the free admission of air, light, and sun to them, especially those that are of tall growth. The onion is the least objectionable, as not rising to any great height, and being capable of being sown at the time the sets are planted out.



It is seldom advisable to take any produce the first year, as where this is attempted much injury is frequently done to the future produce of the plantations. In the Suffolk method of planting, a produce of three, four, and even five hundred weight of hops is sometimes however afforded the first year. And where bedded or root sets are made use of, a small crop may be afforded the first season, as the plants or binds will be nearly as forward at that time, as those from cuttings are in the second season.

Where hop-plantations have been carefully formed in these methods, and the land is perfectly suitable to the growth of the plants, they will continue to bear well for twenty years or more, care being only taken to supply the defects that may occur in particular hills from the destruction of plants. But though this sort of plantation may be continued in the above manner, it is suggested as a more advisable practice, in many instances, to renew them at much shorter distances of time, or even to keep renewing particular parts occasionally as may be necessary. And in order to render them the most productive, whether they are managed by the plough, the spade, or the hoe, the ground in the intervals should be well stirred two or three times when the seasons are favourable, and in other cases more frequently.

In the following winter after the plantation has been formed, it will be necessary to provide and prepare the poles. Where the hop-binds are healthy and vigorous in their growth, two poles may be sufficient for each hill, or in the proportion of two thousand six hundred to the acre. But where the plants are weak and less luxuriant in their vegetation, a greater number of poles will be required, as three to each hill, or at least to each other hill, which in the latter case will be in the proportion of three thousand two hundred and fifty to the acre. But as the poles need not be so long, or of so much strength, there will probably be but little difference in the expense. In bringing the poles they should not be carted upon the ground, but be placed at the outsides, to be afterwards removed by the labourers to the places where they are wanted.

In the second year of the plantation it is seldom necessary to apply any manure to the hills, but the land in the intervals should be stirred in the autumn, in the same manner as in the first; but in the early part of the spring, when the weather is suitable, as about the middle of March, the hills must be opened, and the earth be well cleared away from the principal roots by means of a tool which has the title of a *picker*, in order to afford the means of pruning and dressing the stocks; in which operations all the preceding year's bearing stems are cut off within a joint or two of the roots, and all such shoots or suckers as were not permitted to attach themselves to the poles, or which have risen on the edges of the hills, fully cleared away, nothing being suffered to remain that can possibly injure or prevent the vigorous growth of the new binds. In performing this business, care should be taken to bare the different stalks and roots so completely, and to such a depth, that every thing that is hurtful may be discovered and wholly removed. And in the cutting experienced labourers



should, if possible, be employed; for much depends on the work being properly executed, as great injury may be done by leaving too great a length of bind, as well as by cutting the stocks too closely. In the former case the crops may be exposed to the *canker*, and, in the latter, the hills be so much weakened as not to afford shoots in sufficient abundance. It is therefore necessary that the work should be carefully overlooked. After the business of pruning and dressing has been thus accomplished, the earth should be raked back again upon the plants, so as to rise into hills as before.

At this period all such plants as have been destroyed, or that have a weak and unhealthy appearance, should likewise have others put in their stead, in order that the plantations may be kept as perfect as possible. Such of the prunings as are cut from the most healthy and vigorous plants may be reserved for the purpose of forming new plantations.

In this season, as well as the preceding, three hoeings and one good moulding should be performed; the first about the beginning of May, the second in June, and the third in July; a little mould each time being drawn to the root of the plants on the hills in order to keep them sufficiently moist. The moulding should take place in the early part of August, the earth being well laid upon the hills round the root-stems of the plants; and it should be executed, if possible, soon after some rain has fallen.

In the poling, which is the next operation to be performed, the common rule is to begin as soon as the binds have advanced two or three inches above the surface of the ground, which is in general about the latter end of April, or beginning of May. The number of poles that are the most proper and advantageous for each hill has not been yet well ascertained by planters: but as it has been shown that a full and free admission of air, light, and sun, is essentially necessary to the healthy growth of the plants, they should never be too much crowded. Three is the most usual allowance, though a greater number is often employed. They should be placed in such a manner as to leave the largest spaces or openings towards the south or south-west, that the plants may derive the more full influence of light and heat; and the stoutest on the side which has a northern aspect, the more powerfully to resist the winds. The poles are most commonly fixed in the ground by means of an iron crow, with which holes to the depth of eighteen or twenty inches are formed, and the sharpened root ends of the poles forcibly placed in them, the earth being immediately afterwards well rammed or trodden about them.

The difficulty of this business chiefly consists in pitching the holes to proper depths, in setting the poles down with such exertion as that they may fix themselves firm at the bottom, and that the tops of the poles may have such a direction outwards as to obviate as much as can be, the *housing* of the binds. Where due attention is not bestowed on these points, much injury and loss may be sustained by the destruction of the plants. When the poles are set, two or three of the binds may be directed up each of them, being tied, in the manner advised above, in different places by labourers employed for the pur-



pose, and which is to be repeated as there may be occasion for it. When the poles are high and the binds strong, standing ladders may be useful in tying them near the tops.

It has been observed that this work demands particular attention in the early part of the summer. When short and slender poles have been put to hills where the binds prove of strong and vigorous growth, it may sometimes repay the trouble to have them removed, and others of a taller and stronger kind put down in their stead. The benefit obtained by this practice is often considerable.

During the summer, in the more early growth of the plants, the superfluous binds of every kind should be repeatedly removed as they present themselves, reserving only one or two on each hill to supply the places of such as may be hurt in being trained to the poles at first, as accidents of this nature often occur in consequence of the tender buds being bruised or rubbed off by the agitation of the winds.

This is the whole of the culture that is required till the season at which the hops become ripe, and are ready to be *picked*, which is known by the fragrant smell which they emit, their becoming firm, and acquiring a brown colour. It is usually about the beginning or middle of September.

Much care and circumspection is necessary in the performance of this business, to see that every thing proceeds with regularity and dispatch, as there is always much danger from delay, the crops being equally exposed to injury from the winds as continued rain. As a preparation for this business, *baskets*, *bins*, or *cribs*, are procured or formed, in number proportionate to the extent of the plantation and the pickers that are to be employed. The latter are constructed by nailing four or more pieces of boards on as many upright posts as frames set into the ground. When finished, they are about seven or eight feet in length, three feet in breadth, and about the same in height. The apparatus being thus made ready, the hop-binds are cut over close to the surface of the land by a person accustomed to the work, and the poles drawn up by a tool for the purpose, which is termed a *dog* or *pulling-hook*. They are then placed upon the frame with the bind upon them, mostly two but sometimes three, in order to be picked: three, four, or more pickers being employed in clearing the binds of the hops on each side of the different frames: these, with the person engaged in sorting the poles, are denominated a *set*. Women and children are frequently employed in this work. The hops, after being carefully separated from the leaves and binds, are dropped into a large cloth hung round on tenter-hooks within, underneath the frame. When this has been filled, the hops are put into a large sack, in order to their being taken home, to be dried on kilns for the purpose. This should always be performed as expeditiously as possible after the hops have been picked, that they may not sustain any injury by remaining together in their green moist state; as where this is the case they are often liable, especially when the weather is warm, to be much damaged, both in colour and flavour, in the course of a few hours, by the heat which they take on. For this reason, it is necessary to keep the *oast* or kiln constantly at work, both night and day, during the time of picking. The number of pickers should



therefore be as nearly as possible proportioned to the quantity of hops that can be dried off by the *oast*. And where, from the nature of the season or other causes, the undried hops are suffered to accumulate, they should always be placed only a few together, without being closely packed.

In cases where the crops are pretty abundant, a diligent picker will separate from eight to ten bushels a day, which, when dried, may weigh about one hundred weight. It is usual in many places to let the picking of this crop by the bushel. The price is variable according to the abundance or scarcity of labourers. From sixteen to twenty expert pickers will be necessary, in favourable seasons, and where the produce is rather abundant, to keep an *oast* at work that is capable of drying off eighty bushels at each measuring,

Besides the pole-puller and pickers, another person will be requisite in the hop plantation, in order to pick up the scattered branches of the binds, and convey the produce to the kiln. A boy is in general employed in this business, who, from the nature of his work, is commonly called the *poke boy*. The conveyance of the hops is accomplished by means of a cart, horse, or hand-labour, according to the distance of the plantation from the kiln.

The *drier*, or person employed in the kiln, should be perfectly acquainted with the business, regular and steady, as much of the planter's profit depends upon this work being properly performed. To this part of the management, as well as that of the pickers, the hop farmer ought to be careful to direct his attention as much as possible.

The wages of the different persons engaged in these operations are always considerably influenced by local and other circumstances. In Kent, before the late advances in the price of all sorts of farm-labour, it was usual for the pole-pullers to have from eighteen-pence to two shillings the day, with small beer; the driers half-a-crown, with an unlimited allowance of both beer and spirits; the pickers from three halfpence to two-pence the bushel, with allowances of spirits, &c. These wages, however, at present are greatly advanced.

The structure of the hop kiln, or *oast*, is not very different from that employed in drying malt. It may be of different dimensions, as twelve, fourteen, or sixteen feet square; and have a suitable proportion preserved between the height and breadth and the sides of the steddle that contains the fire: thus, where the kiln is twelve feet square on the top, it should be eight feet in height from the fire; and the steddle six feet and a half square. It is covered with hair cloth, on which the hops are spread out, in an even manner, to the depth of from six or seven, to eight, ten, or twelve inches, according as the season is more dry or moist, and the hops are more or less advanced in ripeness. Before the hops are laid upon the kiln it should be rendered a little warm, and the heat afterwards kept up by a regular gentle fire, increasing it gradually till, by the heat of the kiln and the warmth of the hops, it is found to have attained the proper height. An even steady degree of heat should then be preserved for eight, ten, or more hours, according to the state of the hops at the time they are applied; by which the ends of the hop



stems become in a perfectly shrivelled and dry condition; which, with that of their rattling on being touched, is the principal indication that they have attained the proper state of dryness. Much practical experience is however necessary to conduct the process with the best effect, and in the most economical manner in respect to fuel.

Where what is termed a *cockle oast* is made use of, sea coal is mostly employed as fuel, a chaldron being considered the proper allowance to a load of hops. But where *hair kilns* are in use, as the smoke of that sort of coal would be injurious, charcoal is had recourse to for the purpose, which in Kent is generally bought for about fifty shillings the load, which consists of fifty sacks.

After the drying has been properly performed, the hops are removed from the kiln by means of a shovel, into an adjoining room constructed for the purpose, which is called the *stowage room*. In this chamber they are kept five, or six, or more days, according to circumstances, before they are in a proper condition to be put into the bags; as when they are bagged too soon they are brittle, and do not *draw* so good a sample, or weigh so heavy. They should always remain so long as to attain a tolerable degree of toughness, which may be easily judged of by the feel.

For the convenience of bagging the hops, a round hole or trap is prepared in the floor of the stowage room, exactly equal in size to that of the mouth of the bag, on which a frame of wood is placed, to which the edges of the opening of the bag are securely attached all round. A very small handful of hops being then tied firmly in each of the lower corners, the bag is let fall below, and a person termed the packer gets in, and with a heavy weight, which he keeps continually moving round, where he is not immediately treading, tramples and presses the hops down as closely as possible into the bags, as they are thrown in, in small quantities, by another person employed for the purpose. In this manner he proceeds until it is quite filled, when each of the upper corners has a few hops inclosed in them in the same way as the others, which serve the purposes of handles; and the bag is drawn up, and the mouth of it well secured, after being disengaged from the frame. In performing this business, the closer the hops are pressed into the bags the better, as they preserve their colour, smell, and taste more perfectly.

In the operations of drying and rendering hops proper for the bag, some loss of weight must of course take place. According to some, sixty bushels of well ripened fresh gathered hops, which have not been attacked by the fly, will produce when dried and bagged about one hundred weight.

The goodness of a sample of hops depends upon different circumstances, as the clammy feel of the yellow, farinaceous, powdery substance which is sprinkled over them, and their colour. The former, in the language of the hop planter, is termed the *condition*, and the sample is esteemed the more or less valuable by the buyers in proportion as the feel is more or less clammy; and in regard to the latter, it is of the utmost importance in the sale of the hops,



that it should be preserved as bright as possible, though it is not always the case that those which are the brightest in their appearance are the strongest in flavour.

It is this property, however, that induces the planter to make a distinction in the bagging of the article. The brightest hops, and those which have the finest colour, are put into bagging of a better quality, and termed *pockets*; while those of the brown kind form bags, being put in bagging of a coarser and more heavy sort. The first sort are made use of in the brewing of ales and all the finer sorts of malt liquor; but the latter chiefly in the making of porter. Where hops are to be kept for some length of time, the coarse bagging is however the best.

The length for a bag is about two ells and a quarter, and that for a *pocket* nearly the same, each having an ell in width. The former, where the hops are good, well cured, and tightly trodden in, weigh about two hundred and a half; and the latter, when of the Canterbury pocketing, about one hundred and a half; where they much exceed or fall short of these weights, it may be suspected that they are either of an inferior quality, or have been injured in their preparation. The planter will be best directed in respect to the duty on hops, by perusing the excise laws respecting them.

After these operations have been performed, it will be proper to clear the poles of the binds, and set them up in stacks as soon as possible, unless, as is sometimes the case, it has been done at the time of picking, as they are apt to sustain much injury by remaining upon the ground with the bind upon them. The work is usually performed by the acre, the poles being piled up into square stacks; thirty or forty poles being set to each corner, which should stand about twelve feet apart in each direction at the base, the tops uniting as closely as possible. In this way an opening is formed below, which contributes to dry and preserve the poles.

At this period all such poles as are too short, or in any way improper for further use, should be laid aside, in order that such of them as are suitable may be employed in the new plantations; and that the planter may fully ascertain the proportion of fresh poles that may be necessary for the following season, which it is of great advantage to have provided, brought upon the ground, set up conveniently in stacks, and sharpened, when there is leisure in the winter months. The points of the old ones may also be put in order at the same time, and nothing be thus left to interrupt the business of poling at the proper season. The best poles, which are those of ash, chesnut, and willow, of the length of from eighteen to twenty-four feet, will seldom last longer than six or seven years; and those of an inferior kind, as from beech, maple, oak, &c. not nearly so long. The bark is shaved off all the sorts except those of the ash kind, (in which it separates of its own accord in the second year,) in order to prevent their being destroyed by worms lodging in them.

After the poles have been stripped and stacked up, the bind should be cleared away, which, in some districts, is done by tying it up into



bavins or small bundles when perfectly dry, and putting it in stacks, sheds, or other convenient places, for the purpose of fuel in ovens, &c. This work is performed at the rate of about sixpence the hundred. In others it is burnt upon the ground; and, in some, the labourers are permitted to take it home for their own use. But whatever method is adopted, it should invariably be removed, to prevent its interfering with the future digging of the plantation, which is the next operation to be performed.

This should be executed as early as possible in the autumn or winter months, in order that the land may have the full influence of the frosts. The work should be performed in a dry season, and be accomplished with as much expedition as possible, the most careful and trusty labourers being always employed. It is usually done at a fixed price for one hundred hills, as from two shillings to half a crown. The labourer makes use of a three-pronged fork, which in some places is termed a *spud*, for the purpose, each prong being about an inch and a half in breadth. It is of great consequence that this operation be executed in a very perfect manner, much of the success of the plantation depending upon it. If there should be any binds of an improper kind, they may be now removed, and others of the proper sorts put in their stead.

And though manure may sometimes be omitted in the second year where the soil is very rich, it should be carefully applied before the business of the winter-digging commences in each succeeding one, in the proportion of about twelve full cart-loads to the acre; fifteen loads of good fresh vegetable earth having been well blended and incorporated with it by frequent turning, for ten or twelve months before. In putting this compost upon the land, small one-horse carts with three wheels are sometimes recommended as the best adapted to the purpose. It should be laid in small heaps; and, in digging the plantation, be well blended and intermixed with the mould that surrounds the hills, at the distance of about a foot from them. The old stocks, when they begin to decline, as every tenth or twelfth year, or much longer in some cases, should be taken up, and another portion of ground fresh planted; or, what is better, a suitable proportion of the old plantation, and an equal portion of new, broken up and planted annually, or every other year, so as to preserve a regular succession, at an easy and gradual expense, as has been already observed.

There is scarcely any sort of crop that varies more in the quantity of produce than that of hops, affording, under different circumstances of soil and season, from two hundred to upwards of twenty hundred weight on the acre. On medium soils, in tolerably favourable years, it may be estimated at from six to eight or nine hundred weight, from ten to fourteen being considered as good crops. A produce of twenty hundred weight but rarely occurs, and is much too large for the planter in general to fix his expectations upon.

The whole of the expenses incurred in the cultivation of these crops, and the profits which they afford, are stated in the following manner by Mr. Kent, in his useful Hints to Gentlemen Farmers:



<i>Expenses per Acre.</i>		£.	s.	d.
Medium price of an acre of land suitable for hops	,	1	10	0
Digging the ground	.	0	13	0
Dressing and pruning	.	0	8	0
Poling	.	0	15	0
Three hoeings	.	0	9	0
Once moulding	.	0	3	6
Tying the binds to the poles	.	0	12	0
Stripping the binds off the poles	.	0	3	0
Stacking the poles	.	0	4	0
Sharpening the poles	.	0	10	10
Manuring	.	2	0	0
Picking, drying, and duty, at 1 <i>l.</i> 10 <i>s.</i> per hundred, the crop being estimated at 12 cwt the acre	.	18	0	0
Bagging and occasional expense of bags, about	.	0	16	0
Ash poles, estimated at 30,250 to the acre, and supposed to last eight years, medium price, 18 <i>s.</i> a hundred at the stub, eighth part of which is nearly	.	3	13	0
Carriage of ditto, estimated at	.	1	5	0
		<hr/>		
		31	2	4

*Produce.*

Supposing 12 hundred per acre, and that the medium price is 4*l.* the hundred, the amount will be

48 0 0

And the expenses deducted out of the produce will leave a }  
medium profit of

16 17 8

The expense of forming new hop plantations is very considerable. In Suffolk it is estimated at from seventy-five pounds to one hundred, when every thing that is requisite is included; the annual charges being nearly the same as those which have been just stated.

In the county of Kent, where the practice of letting out the culture of crops of this sort to labourers who are experienced in the business in some measure prevails, they are said not only to find a saving of expense, but to be so much relieved, in respect to the trouble of the different operations, as to consider it the most advisable mode. The account is stated in this way :

		£.	s.	d.
Undertaker's charge, he paying and finding labourers for the different operations	.	3	10	0
Picking, drying, and duty	.	13	0	0
Rent of land	.	1	0	0
Poles	.	6	0	0
Manure	.	2	10	0
Tythe	.	0	10	0
Bagging cloth	.	2	0	0
		<hr/>		
		£.28	10	0

In these cases, where summer digging is omitted, and recourse is had to the use of the nidget, the expense will be a few shillings



more, as is shown in the first estimate; the difference in favour of this practice from that where the planter procures and pays the workmen, being about one pound the acre.

The weather most favourable to crops of this sort, in the different stages of their growth, is that which is warm without much rain, and where south or south-westerly winds prevail; as the hop is a plant which never succeeds well in such seasons as are wet, or when either easterly or northerly winds continue for any great length of time during the summer months. Hot gleams of sunshine after rain, or after foggy mornings, in the latter summer months, also prove highly detrimental to these crops. High winds towards the approach of the picking season likewise produce considerable mischief, by bruising and otherwise injuring the hops. When unfavourable weather takes place, about the period in which the plants are in blossom, it is seldom that the produce is good or abundant, as many of the *burs* generally suffer in such a manner as to prevent their forming perfect hops.

In most cases the very forward binds suffer more from all the different accidents to which hop crops are exposed, than those that are later and of a less vigorous growth. It may, on this account, therefore, sometimes be advisable to remove all the very forward binds.

These crops are exposed to the attacks of disease at almost every period of their growth. In the very early stage of the growth of the hop plant, it is liable to be wholly devoured, as it rises above the surface of the ground, by the ravages of the *flea*. And, in a more advanced state, it is subject to the still more prejudicial attack of the *green* or *long-winged fly*, *red spider*, and *otter moth*: the first of these by the deposit of their ova, afford the means of producing *lice* in great abundance: by which the plants are often very greatly if not wholly destroyed, and the larvæ of the last prey upon the roots, and thus render the plants weak and liable to be attacked by other diseases. The *honey dew* is likewise another disease to which the crops are exposed about the same time, and by which they are often much hurt. The *mould* or *fen* mostly occurs at a somewhat later period, but is equally prejudicial in its effects. There are still other injuries to which hop-crops are exposed, such as the *blight*, and what is termed the *blast*, which occur at different times, but mostly towards the latter periods of the growth of the plants.

The *flea*, which is asserted to be an insect of the same kind as that which is so destructive to the young turnip, is said to make the greatest havock in those seasons when the nights are cold and frosty and the days hot and inclined to be dry. In its attacks it eats off the sweet tender tops of the young plants; and which, though they are not wholly destroyed by it, shoot forth afterwards in a much less strong and vigorous manner; from which they become more exposed to the attacks of other vegetable diseases. It has been remarked that this insect is the most apt to commit its depredations on the plants in those grounds that have received a proportion of dung the same year. And on the supposition that dung in its crude state has a tendency to encourage the production of this insect, it has been suggested that the manure employed for the purpose of



covering the hills should be previously well mixed and incorporated with good fresh mould for a considerable length of time before it is made use of, as has been already directed; and that it should be applied either over the whole of the land, or only the hills, immediately after the plants have been cut over: the first is the most advisable practice where manure can be easily obtained.

This insect commits its greatest depredations in the more early cold spring months, as the latter end of April and beginning of the succeeding month, disappearing as the season becomes mild and warm.

The principal remedy in this case is that of having the land in a sufficient state of fertility, to enable the young plants to shoot up with such vigour and rapidity as to become quickly incapable of being fed upon and devoured by the insect. Stirring the mould about the roots of the plants by means of the hoe may also be of utility in the same intention.

The *green* or *long-winged fly* generally makes its appearance about the latter end of May, and in the two following months. The prevalence of north easterly winds about the above period has much effect in producing these insects, which are very destructive of the young leaves of the plants. Under such a state of the wind they are said to scarcely ever fail covering the leaves; and by dropping their ova produce an abundance of *lice*, by which the crops are often much injured, as when they have once obtained complete possession of the plants they seldom or ever leave them before they are wholly destroyed. The forwardest and most luxuriant hop-binds are said to be in general the most disposed to be attacked by insects of this sort. The removal of the insects chiefly depends upon a change taking place in the wind from the above points more to the south, and the setting-in of mild and warm weather.

The *otter moth*, by producing its larvæ upon the roots of the plants, subjects them to be attacked by them, and the healthy growth of the hops to be in that way greatly impaired, the crops being of course much injured in respect to their produce. In this case, stirring the earth well about the roots of the plants may probably sometimes be serviceable.

The *honey dews* mostly occur after the crops have been attacked by some of the above kinds of insects, and when the weather is close, moist, and foggy. In these cases a sweet clammy substance is produced upon the leaves of the plants, which has the taste of honey. They have at first a shining appearance, but afterwards soon become black. The nature of this vegetable affection does not seem to be yet well ascertained. It is supposed by some to be the excrement of insects of the *aphis* kind, deposited by them upon the leaves of the plants after it has been extracted by their puncturing them. Others however contend that it is a morbid exudation proceeding from the plants themselves; which is much more probable, and more consonant to analogy: since from its taste, which resembles that of the vernal sap-juice of plants, and its supporting bees, ants, and other insects, it must be of a nutritious quality. This supposition is rendered still more probable from the circumstance of its occurring



after the insects have been some time present upon the plants, and disappearing long before they leave them. It would appear indeed that this exudation may in some measure be caused by the punctures of the insects, as it most commonly takes place after the nights have been cold, moist, and foggy, and the succeeding days hot and sunny, the irritability of the plants being so much increased by the former as to render the action of the latter more powerful in promoting the circulation of their juices, and consequently in forcing their passage more abundantly through the fine openings afforded by the punctures of such insects.

This disease mostly happens in the more forward crops. The chief dependence of the planter for its removal is that of heavy thunder showers taking place, as by this means, when the destruction of the hops has not proceeded too far, they are often much restored, the insects that devour the leaves and binds being greatly destroyed, the growth of fresh shoots promoted, and a favourable bloom brought on.

The *fen mould*, or *mildew*, is a disease to which the hop is exposed at a later period of its growth. It chiefly attacks the part where the hop is attached to the stem. Its production is greatly promoted by moist damp weather and a low situation; those hop-crops that grow on low, close, rich grounds being the most liable to be attacked by it. It is found to soon spread itself over the whole crop, after it has once seized upon any part of it. The nature of this vegetable disease is not probably yet perfectly understood. It has lately however been ingeniously suggested to be a plant of the fungus kind, that is capable of growing without light or change of air, attaching itself to the plants already in a morbid condition, and by its roots penetrating their vessels. On this supposition, the best remedy is believed to be that of thinning the plants or wholly removing those immediately about it, in order to afford a more free circulation of air, and admit the light more extensively; by which the vigour of the hop-plants may be restored, and the disease be of course removed. If this opinion of the nature of the disease be well founded, it is probable that by planting the hills more thinly, and making them at greater distances from each other, this vegetable malady might be in a great measure prevented from occurring in those situations where it most frequently shows itself.

*Blights* are frequent in hop-crops; but the causes of them do not appear to have been yet nicely investigated. They are found to happen at different periods of the growth of the plants, but most frequently in the more early stages of their rising from the hills, while the nights are cold and frosty in the spring months, and the days have much sun and heat. The living powers of the plants being in these cases greatly exhausted in the day-time by the stimulus of heat, may of course be much injured, or wholly destroyed in the nights, from being exposed to a freezing air, which is incapable of exciting the actions necessary to the preservation of vegetable life.

The *blast* is likewise a disease that hop-crops are exposed to, especially in the latter periods of their growth. This is in general



supposed by planters to depend upon or proceed from the particular state of the air or weather. It is more probable however that it may be the effect of lightning, as it occurs for the most part at those seasons when it is the most prevalent, and takes place in a very sudden manner. And besides, lightning is known to produce similar effects on plants, by exhausting their irritability, and thus rendering their vital actions incapable of being excited by the ordinary powers that support them. This is rendered still more probable from the practical fact, that the most forward and most luxuriant binds are the most subject to be affected in this way. In exposures that are particularly liable to have the crops injured in this manner, it may be advisable to keep back the growth of the plants as much as possible, by extirpating all the most forward shoots, as well as by employing a less proportion of the earthy compost in their culture. By having the plants to stand at greater distances than usual from each other, advantages may likewise probably be obtained.

In the former of these two last diseases, the presence of which is supposed to be much connected with the prevalence of winds from the northern or easterly quarters, there is frequently a *flea* produced of a similar kind to that which attacks the binds in their early growth. This is highly prejudicial by preying upon the *condition* of the hops, and thereby diminishing their weight, and changing them to a brown colour; which is of much injury in their sale.

It is the practice in some districts for planters to sow turnips or set cabbage plants, or some other similar crops, in the intervals of crops of this sort; but it is an injudicious method, which should seldom or never be attempted.

The advantages of the cultivation of hops have been differently stated by different cultivators; some contending that it is beneficial in a very high degree, while others are equally positive in affirming that it is a sort of culture that only affords a very trifling profit. It is evident however that in many situations the growth of this plant must be extremely beneficial, though, like most others, it must be subject to vary, according to the circumstances of soil, culture, and climate. Experiment has indeed shown, that on the deep boggy soils, after being rendered sufficiently dry, the black vegetable moulds and rich loams, it is a culture that answers to a very high degree; and that, under other circumstances of a much less favourable nature, it is so profitable as to far exceed common husbandry. It may indeed be concluded, that though on lands that are perfectly adapted to these crops, and so situated as to afford poles, manure, and labourers for performing the business of picking and other operations in sufficient proportion and on reasonable rates, they may be highly beneficial both in respect to the immediate money profit they afford, and the great improvement that is accomplished in the lands from the nature of their culture; yet under other circumstances, from their precariousness, and their being attended with much trouble, it may be better either to wholly omit them, or only cultivate them on a limited scale. And where they are cultivated in connection with farms, it should only be to such an extent as that



no injury may be sustained by the other parts either in tillage or manure.

*Woad.*—This is a plant which has a thickish strong fibrous root that penetrates to a considerable depth in the soil. It is principally cultivated for the leaves, which, after being properly manufactured, are employed in the art of dyeing in order to produce a blue colour, and also as the basis of black and some other colours\*.

From the nature of its root it obviously requires a soil which has much depth, and which is rich and perfectly fresh. Those of the rich, mellow, loamy, and putrid vegetable kinds are in general the most adapted to it. In Lincolnshire, where its culture is carried to a considerable degree of perfection by some cultivators, the deep, rich, putrid, alluvial soils on the flat tracts extending upon the borders of the large rivers are chiefly chosen for the growth of this plant. And experience has shown that it succeeds in the most perfect manner when they are broken up from a state of sward immediately for its reception. It is frequently the practice of cultivators of this plant to take lands of this description at high prices, for the purpose of breaking them up and growing it upon them for a few years;—on the more low rich soils, sometimes for four years, but in those of less fertility only for three; and in some which are more elevated and exposed in their situations, two is thought sufficient; persons accustomed to this sort of culture, who move from place to place and form a sort of colony, being engaged in the business. It has been found however, by the ingenious cultivator mentioned above, to be capable of being confined to one spot with equal or more success, by having a sufficient extent of ground for changing the place of its growth as may be necessary, and for appropriating an adequate proportion annually to the raising of the plant, by which the houses and machinery that are necessary for its preparation may be kept regularly in employ.

In preparing the land, it is recommended by some to plough it up with a good deep furrow, just before the winter commences, laying it in narrow high ridges that it may have the full effect of the frosts. Early in the spring another ploughing should be given in the contrary direction, leaving it in the same kind of ridge as before. After it has remained in this state some time, and weeds begin to appear, it must be well harrowed down with a pretty heavy harrow, repeating the operation as frequently as may be necessary to render it perfectly fine and clean. In the beginning of June a third ploughing should be performed to the full depth with a narrow furrow, the land being afterwards well harrowed down as in the former cases. And about the end of July or the beginning of the following month the final ploughing must be given, which should be light, and the surface left as even as possible for the reception of the seed.

Other cultivators, however, take much less trouble in this business. Where the soils are sufficiently dry, they break them up early in the month of February; but where the contrary is the case, it is deferred to a later period. In performing the work, great care

\* It is the *Isatis tinctoria*, or dyer's woad.



is taken to plough it in a perfect manner to the depth of about five inches. And in order that the furrow-slices may be well turned, laid flat, and nicely jointed, a person is employed in the furrows with a spade for the purpose. This is found requisite to prevent the grassy matters from rising in the seams. After this the surface is repeatedly harrowed over, in order to raise a sufficient depth of good mould for the drill to work in ; and before the seed is put in a roller is passed over it.

This method is probably however inferior to that first described, as the land cannot be brought by it to nearly so fine a state of mould, or the grassy material be so effectually destroyed ; it will therefore be apt to rise and injure the woad plants:

But there is still another method which is more expeditious, and at the same time equally effectual with the first ; and which has an advantage over it in more completely destroying the grubs and insects which are apt to feed on the plants in their early growth. This is that of paring and burning. It is however chiefly practised where the sward is rough and abounds with rushes, sedge, and other coarse plants.

After this, in the last two methods, the land is to be carefully drained by making grips in suitable directions, by means of the spade, as wherever water stagnates the woad plants are sure to be destroyed.

*Seed.*—This is collected from a portion of the ground that has been left covered with the best plants from the preceding season, as they only run up to stem and produce seed in the second year. It is sometimes a practice to crop the leaves of the plants that are intended to stand for this purpose, two or three times in the first season ; but this is an improper custom, as they are thereby much weakened in their growth, and not only afford a less quantity of seed, but such as is of an inferior quality. It is a better method either not to crop them at all, or but once, as by such management, seed of the most perfect quality may be obtained. The stem should be suffered to remain till the seeds in the husks become perfectly ripened ; which is known by their attaining a brownish yellow colour, and the pods having a dark blackish appearance. The seed should then be gathered as soon as possible, which is best performed by reaping the stems in the same manner as grain, and then spreading them in rows thinly upon the ground if the weather be fine ; when in the course of a few days they will be in a condition to be threshed out from the husks. When they are suffered to remain too long, the pods are apt to open, and shed the seed. The husk or pod, in which the seeds are included, is of a large size, but the seeds are less than those of the turnip. It is always the best to sow new seed, when it can be procured, in preference to such as has been kept for some time ; when of the latter kind, it should be steeped for twelve or fifteen hours before it is sown.

In respect to the proportion that may be necessary to be sown upon an acre, it must depend much upon the soil, and the manner in which it is sown. Where the drill is employed, less will be necessary than in the broadcast method. A rood of land, where



the crop is good, will in general afford seed sufficient for eight or ten acres. In some places six bushels are made use of to the acre, in the broadcast method.

*Time and method of Sowing.*—The period of putting crops of this sort into the ground must depend in some measure upon the method of preparation that has been adopted. Where the first of the methods that have been mentioned is followed, it must be much later than in the other cases. Early sowing is in general to be preferred, as there will be less danger of the plants being destroyed by the attacks of the *fly* or *grub*. When the weather is suitable, and the land in a proper state of preparation, the seed may therefore be sown in the latter end of February or in March, continuing the sowings, in different portions of land, till about the middle of May, at suitable intervals, to vary the times of cropping the leaves of the plants. The late sowings are generally performed about the latter end of July, or beginning of the following month. In Somersetshire they sow it in June.

The manner in which the seed is put into the ground is different, according to the nature and state of preparation of the land. When it is in a fine state of mould, the drill or row method, is the most generally practised; and is by much the best, as the plants may be kept more easily clean from weeds, and become more vigorous from the earth being more stirred about the plants: but where the contrary is the case, the broadcast plan is mostly followed; though it does not by any means admit of the plants being kept so free from weeds, or of the mould being so well stirred about them.

In the first method, the seed is put in by a drilling machine, such as is employed for turnips, in equi-distant rows, about eight or nine inches apart, being covered either by means of a harrow which is attached to the implement, or by passing a light common harrow over it afterwards once in a place; and if there be any clods, they should be raked off to the sides, or into the furrows. In the latter mode, it is dispersed by the hand in as equal a manner as possible over the whole of the land, being then harrowed in by a light harrow, so as to leave the land in as even and level a state as possible. In either way the land is frequently rolled afterwards, in order to leave the surface as even and neat as it will admit of.

When the season is favourable and the seed is of a good quality, the plants mostly appear in the course of a fortnight; when much attention should be paid to them to see that they are not destroyed by the *turnip-fly*, or the frosts in those of the more early sowings; as, where that is the case, the land should be immediately sown again. In some places it is not uncommon to sow the greatest part of the crops two or three times over. And in the very late sowings, where the crops are thin on the ground, it is sometimes a practice to render them more thick by forming holes with a triangular hoe in the vacant spaces, and directing persons to drop seeds into them by the hand: women and children may be employed in this business. This mode is often practised for the late spring sowings till the beginning of June, or even later.

*After-culture.*—As the goodness of the woad plants depends



upon the luxuriance of their growth and the thickness of their leaves, much attention is necessary to the after-management of the crops. In the spring-sown crops, as well as those that are put-in in the latter part of the summer, the first hoeings should be performed as soon as the plants are fully distinguishable; as by this means the weeds will not only be prevented from retarding the vegetation of the plants, but these, by being thinned out to greater distances, will be more at liberty to advance, and become vigorous in their first growth, which is a matter of great importance to the success of the crop. In the second hoeings, which should be given in the course of four or five weeks after the first, the plants are to be thinned out to the full distances at which they are to stand, which may be six or seven inches, or more, according to the fertility of the soil, always leaving sufficient spaces to prevent the plants from being in any way crowded. This business is in some cases executed in the same manner as for turnips, by means of hand hoes; but in others it is performed by small short *spuds*, managed with one hand, while the other is employed in clearing away the weeds; the labourers, who are mostly women and children, kneeling while they are at work. After this nothing more is done till the first cropping of the leaves has been performed, when the plants are again immediately well weeded; and after each cropping the same operation is had recourse to; the extent of crop cleared in the day being, in most cases, weeded before night.

In the late mode of sowing, after the second weeding in October, nothing further will be requisite till the spring, about the middle of April, when the work should be again well executed, the mould being fully stirred about the roots of the plants, in order that they may derive the fullest advantage from the process. This will be sufficient to keep the plants clean till the taking of the first crop; after which the plants must be again weeded, and the same operation be performed after each cropping of the leaves of the plants, as in the former case.

The expense of performing this business will be different in different cases; but where labourers are in sufficient number, the first hoeing will mostly be done at about six or seven shillings the acre, and the succeeding ones at about half the price, provided it be executed before the weeds have risen to too great a height. In many places, the business of weeding and cropping the leaves of the plants is performed by the same persons, at a fixed price for the acre, according to circumstances.

*Gathering the crop.*—In the spring-sown crops the leaves are generally ready gathered to be towards the latter end of June or beginning of July, according to the nature of the soil, season, and the climate. But when put in at a later period in the summer, the crops are often fit to be gathered earlier. This work should, however, always be executed as soon as the leaves are fully grown, while they retain their perfect green colour and are highly succulent; as when they begin to turn pale much of their goodness is expended, and they become less in quantity and of an inferior quality.



In performing the business, a number of baskets are provided in proportion to the extent of crop, and placed in the field, into which the leaves are put as soon as they are taken from the plants, which is done by the hand, by grasping them firmly and giving them a sort of twist. On good soils, in favourable seasons, the plants will often rise to the height of eight inches or more; but in other circumstances they seldom attain more than four or five: and where the lands are well managed, in respect to the culture of the plants, they will often afford two or three gatherings; but the best cultivators seldom take more than two, which are sometimes mixed together in the manufacturing of them. The after croppings, when they are taken, are constantly kept separate from the others, as they would injure the whole if blended together, and considerably diminish the value of the produce. The best method, where a third cropping is either wholly or only partially made, is to keep it separate, forming it into an inferior kind of woad. The produce upon an acre of land, when well managed, in favourable seasons, is mostly from about a ton to a ton and a half. The price varies considerably, but for woad of the prime quality it is often from twenty-five to thirty pounds the ton, and for that of an inferior quality six or seven.

In the parts of the crops that are reserved for seed, it is a practice with some cultivators to crop the leaves two or three times the first year, and then leave the plants to run up to seed in the following; but it is a better practice to only remove the side leaves, as in this way the plants are less weakened, and the produce of seed is much greater. The plants are likewise sometimes fed down by sheep during the winter season; but this, from its tendency to weaken them, is equally improper.

In the preparation of the woad several processes are necessary after being gathered into the baskets: it is, in the improved method, conveyed in one-horse carts, so contrived as to be lifted from the axis, and, by folding doors in the bottoms, to discharge their contents upon the floor above the mill, on being hoisted up to their proper situation: round this floor holes are formed for putting the plants down through, in order that they may drop under the grinding wheels. The mills for this purpose have several wheels for grinding the plants, which have less diameters on one side than the other, and are about three feet in width, being constructed with iron bars for crushing the woad. They are wrought by horses, or any other power, as may be the most convenient. The materials are preserved under the grinding wheels by proper contrivances, which, as soon as they are sufficiently reduced, force it out of the tracks upon the stone floors on the sides; thus making way for new parcels without the mill being stopped. The bruised woad is then thrown into rooms on the sides of the mill, destined for its reception, by means of shovels. In these it remains till the juice is so much drained off as to leave it in a proper condition for being formed into balls; which is done by labourers, with apparatus for the purpose, and then laid upon trays to be conveyed



to the drying ranges, in which they are placed upon grating shelves that slide on ledges in the drying houses. These are placed on the sides of galleries for the convenience of being easily placed upon them and removed again. It is kept in these till it is sufficiently dry to be laid up in other rooms, until the whole of the crop has undergone the same operations, and the workmen are ready to manufacture it.

In order to prepare it for use in the art of dyeing, it is necessary for it to take on a proper state of fermentation. This is accomplished in the course of seven or eight weeks, and in the technical language of the art is termed *couching*. It is effected by regrinding the balls, in the same mill as before, to a fine powder, and then spreading it upon the floors of the rooms in which the balls were formed, to the thickness of about three feet; where it is then moistened with water, so as to keep it in a proper slow state of fermentation; and so managed by turning as that it may pervade the whole in an equal manner. In this business the direction of an experienced workman is necessary. In the turning, it is of much importance that the parts of the materials be perfectly divided, which can only be effected by a nice management of the shovel.

Much advantage has been found in the goodness of the woad, from the drying and storing of it being performed in a careful manner. When this attention is neglected, the woad will not, on being broken between the finger and thumb, draw out into fine hair-like filaments, or in the language of the manufacturer, *beaver* well; as the use of this substance, in the blue vat of the dyer, is not merely to afford the colour of the plant, but, by bringing on a very gentle fermentation, excite the indigo in the same vat to yield its colouring principle more perfectly. This is even necessary for its own colouring matter being fully imparted. The substance should therefore be so prepared in the different operations as to produce this effect in the most certain and perfect manner. When the heat in the process of *couching* has gone too far, the substance will be what is termed *foxy*; and when it has not proceeded to a sufficient degree, it will be what is called *heavy*. If the material be good, it does not soil the fingers on being rubbed between them; but such as is heavy does. In the conclusion of the process, the cooling is effected in so gradual a manner as to render it not fit for taking on the same process; and of course proper for being preserved in casks, or in any other way. It is then ready for use.

As the demands for this article are in some degree confined, it is not a sort of culture that can be extended in an unlimited manner. Besides, as there is much risk and anxiety attending the cultivation and preparation of such sorts of crops, and a great expense of machinery, it is probable that many other kinds of root and other crops that are less exposed to hazard in their growth, and trouble in their preparation and after-management, may be grown on soils that are proper for this plant, with more profit and advantage.

*Weld*.—This is another plant that is cultivated for the sake of its



flower-stems, which are employed in the art of dyeing, for the purpose of producing the bright yellow and lemon colours \*.

The soils most adapted to the culture of this plant are those of the more fertile mellow kinds, whether of the loamy, sandy, or gravelly descriptions; but it may be grown with considerable success on those of a poorer quality. In the former, the plants will however rise to a much greater height, and produce much larger leaves than in the latter.

In the preparation of the ground, it is necessary that there should be a considerable degree of fineness produced in the mould. This may be effected by different ploughings, performed in the more early spring-months, and by occasional harrowing. In giving the seed furrow, the land should be left in as even and level a situation as possible on the surface, in order that the seed may be dispersed over it in a more equal and regular manner.

*Seed.*—It is necessary that this should be collected from the best plants, and that it should have remained upon the stems till it has been rendered perfectly ripe: as that which is not well ripened never vegetates well. The plants designed for seed should not, however, be let stand too long in the field, as the seed is liable to shed; and it should be perfectly fresh when sown, as that which has been long kept never comes up well, or in so even a manner. As the seed is very small, the surface mould, by being left in a fine condition, is more fit for its being dispersed over it equally. The proportion of seed that is necessary is generally from about two quarts to a gallon the acre, according to circumstances, where it is sown alone; but when mixed with other crops a little more may be required. It should be mixed with a little sand at the time of sowing it.

*Time and method of sowing.*—In this, as in the preceding crop, the seed may be put into the ground either in the spring, as about the latter end of April or beginning of May; or in the close of the summer, as about the beginning of August; but in the former periods, it is mostly sown in conjunction with other crops. But when sown alone at the latter season, the produce is in general the most abundant. In Norfolk they sow it in April with barley in the proportion of from one quarter to half a peck to the acre, in the manner of clover, and frequently with clover at the same time, to be mown or fed in the following year after it is pulled.

This sort of crop is commonly sown broadcast, whether it be grown in mixture with other plants or alone; and as the seeds are of a very small size, it requires an expert seedsman to perform the business with regularity and exactness; which is a matter of much importance to the success of the crop, as where the plants stand too closely together, much unnecessary trouble and expense must be incurred in the thinning them out by the hoe afterwards; and where they stand too thinly upon the ground, there must be great loss from the deficiency of plants. In order that the sowing may be executed with more regularity, it is the custom with some cultivators to blend some

\* It is the *Reseda Luteola*, and is commonly known by the name of *Woad*, *Weld*, and *Dyer's Weed*.



other substance with the seed that has nearly the same weight, such as that which has been just noticed, as, in this way, they suppose it to be effected with greater facility and dispatch.

Where the weld is grown with other sorts of crops, as barley, buck-wheat, beans, peas, clover, or grass seeds, it is put in after them; in some cases immediately, but in others, not till some time has elapsed. With the first and second, when sown so late as the beginning of May, it is mostly the practice of the best cultivators to put it in directly afterwards, giving the land a slight harrowing with a very light close-tined harrow, to cover it. With some, the barley being put in under furrow, the weld seed is immediately sown upon the surface, lightly harrowed in, and then rolled. But where the barley seeding is performed so early as March, or the beginning of April, the sowing of the weld seed is best deferred till May, when it may be dispersed over the land, and left in that manner to be washed in by the rains. But with beans and peas, it is often put in before the last breaking or hoeing of the crops in the latter end of June, or beginning of the following month. When cultivated with clover and grass seeds, it is sometimes put in at the same time with them; but it is probably a better practice to delay it till some time afterwards, as both these crops require to be sown at too early a period for this plant.

Where no other sort of crop is grown with the weld, the usual method is that of sowing it evenly over the surface of the land, and covering it in by harrowing with a light common or bush-harrow, finishing, when the soil is of the light kind, by passing a roller over it.

*After-culture.*—In the common practice of cultivating crops of this sort, no attention is afterwards paid to them. But as the plants are of slow growth, and of course liable to be greatly injured in their progress by the rising of weeds, it must be of much advantage not only to keep them perfectly clean from them, but also to have the mould stirred about the roots of the plants. In the course of about a month from the time of sowing, the plants are mostly in a state to be easily distinguished; a hoeing should, therefore, be then given when the weather is dry, which may be performed in the same manner as for turnips, making use of somewhat smaller hoes for the purpose. It is advised by some to set the plants out, in this operation, to the distance of three or four inches; but it will probably be better to let them have more room, as six, seven, or eight inches; which will not only lessen the expense of the business, but contribute to the advantage of the crop. When this operation is well executed, nothing further will be necessary till the spring, when a second slight hoeing may be practised about March, in a dry time; and if any weeds rise afterwards, a third may be performed in May. But where the land has been well prepared, one in the autumn and another in the spring may be fully sufficient. In some cases hand-weeding is practised, but it is in general too expensive a method.

The most proper time for pulling this sort of crop is when the bloom has been produced the whole length of the stems, and the



plants are just beginning to turn of a light or yellowish colour; which is usually about the beginning or middle of July in the second year. The plants are usually from one to two feet and a half in height. It is thought by some cultivators to be advantageous to pull it rather early, without waiting for the ripening of the seeds, as by this means there will not only be the greatest proportion of dye, but the land will be left at liberty for the reception of a crop of wheat or turnips. In this case a small part must be left solely for the purpose of seed.

In performing the business the plants are drawn up by the roots in small handfuls, which are usually set up to dry, after each handful has been tied up by one of the stalks, in the number of four together in an erect position against each other. Sometimes they, however, become sufficiently by turning without being set up. After they have remained till fully dry, which is mostly effected in the course of a week or two, they are bound up into large bundles, that contain each sixty handfuls, and which are of the weight of fifty-six pounds each: sixty of these bundles constituting a load. These last are tied up by a string made for the purpose, and sold under the title of *would cord*.

As the weld plant is extremely uncertain in its growth, and the whole crop seldom becomes in a state to be pulled at the same time, it is necessary to have an experienced labourer to direct the business of pulling, in order that the pullers may not proceed at random, but take the different parts of the plants become ready, or in danger from the blight. In this last case the greatest possible dispatch should always be made, as the loss of weight in the produce will daily increase, and the grower be of course greatly injured.

When the weld is sufficiently dried, which may be known by the crispness of the leaves, and the stems turning of a light colour, and when the plants are ripe, the seeds shelling out; according to some, it should be stacked up lightly in the barn in order to prevent its taking on too much heat; while others advise, that it should be stacked up closely in the manner of wheat, being left to sweat in the same way as hay, as the more this takes place the better; the quality of the weld being thereby increased, if there be no mouldiness.

If the crop has stood till it is perfectly ripe, the seed may be taken before it is put into the barn, which may be easily procured by rubbing, or slightly beating each of the little handfuls against each other over a cloth, tub, or any other convenient receptacle, as, by threshing, the quantity of the weld would be much reduced in weight. The price of this sort of seed is mostly about ten or twelve shillings the bushel, which may be sold to the seedsmen.

The produce of crops of this kind is in some degree uncertain, much depending upon the nature of the season; but from half a load to a load and a half is the quantity most generally afforded, which is commonly sold to the dyers at from five or six to ten or twelve pounds the load, and sometimes considerably more. It is mostly bought by persons who afterwards dispose of it to the dyers occasionally as they find it convenient. The demand for it is sometimes very little, while at others it is so great as to raise the price to



a high degree. The expense of cultivating this sort of crop has often been estimated below one pound the acre; but that is much too low were proper attention is bestowed in preparing the land, and in the hoeing and other management of the crop afterwards. Without taking in the value of the land, tythes, or other charges, it must constantly stand much higher.

Crops of this kind are particularly liable to be injured by the *blight*, which is probably the reason that has induced cultivators to raise them with those of other sorts, especially those of the grass kinds, as by that means, where the weld does not succeed, a portion of sheep-feed may be afforded for winter and spring use.

The blight frequently comes on so suddenly, that crops which appear healthy and in a vigorous state of growth during the winter and spring, promising a large produce, are about the month of May attacked so as to be nearly destroyed. It is known by the plants, especially about the lower parts of the stems, turning of a yellowish or pale reddish colour, while the upper parts remain green and seem healthy. When it appears early in the month of May there is always danger of the crop being destroyed; but when it comes on at a later period, or where the plants from other causes, as the dryness of the season, begin to change colour in the shanks, the only chance is that of having them pulled as expeditiously as possible.

Although the practice of sowing weld with other crops has been common, it would seem more proper to cultivate it alone; as in that way it must be much injured and restricted in its growth, from the great closeness and shade produced by the plants that surround it. The only objection to the cultivating of it alone is, as has been just seen, in the danger of the crop being destroyed by the blight, in which case the farmer will have nothing left to repay him for his expense and trouble; whereas, when grown with other crops, they may in such cases in some measure defray them\*.

It is usual with the cultivators of weld when it is grown with other crops, especially those of the grass kind, to feed them down, in the winter and spring, with sheep or other sorts of live stock, under the notion that they will not touch the weld plants: but this is not the fact, as they are found to feed upon them, and must of course be greatly injured in their growth: caution must therefore be used in directing the feeding down of clover or other crops where the weld plant is present.

There can be little doubt but that crops of this sort may be cultivated with much profit in some cases, where the soil is adapted to its growth, and from its nature not disposed to the blight, or to lose its moisture too much in the summer months; but under the contrary circumstances its culture should not be attempted.

When the weld cannot be disposed of soon after it is pulled, it may be preserved perfectly good several years by being put up in stacks, either in the barn or the open air, care being taken to keep it from being injured by the attacks of rats or other vermin.

*Madder.*—This is another plant of the perennial kind, that is sometimes cultivated in large plantations in the field, for the sake of its long thick fleshy root, which is employed in the art of dyeing, for



the purpose of giving a scarlet colour\*. It was formerly much more cultivated in particular districts than it is at present; the importations from Holland having lessened the demands, and reduced the price of it so much as to render its culture incapable of being conducted with profit to the farmer.

The soils the most suited to the cultivation of this plant are those of the deep fertile sandy loams that are not retentive of moisture, and which have a considerable portion of vegetable matter in their composition. It may also be grown on the more light descriptions of soil that have sufficient depth, and which are in a proper state of fertility.

In the preparation of the land for the reception of the crop, it will be necessary to plough it up deeply before the winter into high ridges, in order that it may be exposed to the action and influence of the frosts. And it should be well water-furrowed, that it may be kept quite dry. Early in the spring these ridges should be well harrowed down by a heavy long-tined harrow, and then ploughed again in the contrary direction to a good depth; and when, after this, it is not perfectly clean from weeds, or not rendered sufficiently fine and mellow, another ploughing and harrowing may be given. In the last operations, the ground should be left in as level a state as possible. It is then ready for the reception of the plants.

*Sets.*—The plants may be obtained either by sowing the seed upon a bed of earth which is rich, and made perfectly fine by digging and raking, in the spring, it being lightly covered in, or from offsets or suckers from the old plants. In the first method, on the plants appearing they should be made perfectly clean by weeding, and be set out to the distance of three inches in the beds by the hoe. In this way, by keeping the ground quite clean and well stirred about the plants, they will be ready to set out in the second autumn, though it will mostly be better to defer the business till the spring. The latter practice is the better in this climate, if the sets can be procured, as the plants seldom ripen their seed perfectly, or afford it in a state to vegetate well. It requires about twenty thousand plants for setting an acre of land.

*Time and Method of Planting.*—The proper time of taking the sets is shown by the plants having obtained the height of ten or twelve inches from the ground, and the suckers having thrown out fibrous roots at their bottoms. This may be seen by drawing up a few of the plants, and is usually about the latter end of May or beginning of June. It is quite necessary that the sets have formed root fibres at the bottoms before they are removed, as where that is not the case they scarcely ever succeed well.

The plants being in this situation, and the land prepared as before directed, a sufficient number of labourers are to be provided, that the work may be performed as expeditiously as possible. In taking off the sets, much care is necessary not to injure them. Some perform it by means of a dibble with a flat edge, and which is shod with iron: this tool, on being thrust into the ground on the side of the shoots, divides and separates them by depressing the handle,

\* It is the *Rubia tinctoria*.



without hurting the fine fibrous roots. The number of plants that can be set in a short space of time should only be taken up at once. They should be prepared by having about a third of their top parts cut off. A sort of thin batter should likewise be made by mixing good vegetable mould and water well together, into which the roots of the sets should be dipped before they are placed in the earth, as by this means the necessity of watering the plants afterwards is prevented. This work is executed by a person before the planting commences. Two others are employed afterwards in distributing the plants so as to be convenient for putting into the ground.

There are different methods employed in setting the plants: in some cases they are put in the furrows by means of the plough, while in others they are set in beds by a dibble. The former is probably the better method, and, as being the most expeditious, is the best adapted to the culture of the plant on an extensive scale. In this, the planter begins by drawing a strait furrow on one side of the plantation to a good depth: a row of plants is then laid in it by a person for the purpose, at the distance of five, six, or more inches from each other, according to the circumstances of the land, in such a manner as to lean off from the plough; another furrow is then formed, by the mould of which they are covered. In this manner the work proceeds until the whole is finished.

In the other method the sets, after the land has been formed into beds of five feet in breadth, with two feet between each for intervals, are put in by means of a line and dibble, beginning at the distance of six inches from the outsides, and setting a row of plants at suitable distances from each other, as just mentioned; then removing the line two feet further on them, and putting in another row; after which it is again removed two feet, and a third row of plants set in, which finishes the bed; the work proceeding in the same manner till the whole of the plantation is completed. In this way, each bed contains three rows of plants at two feet distance each, three feet being left between the rows on the different beds.

In Holland, where the culture of this root is extensive, their method is a little different from the above. The plants, after being taken from the older plantations about the month of May, are immediately set in rows at the distance of three or four inches from plant to plant, and about fifteen inches from row to row, the beds being ten or twelve feet in width, with intervals of only about two feet.

As, in whatever manner the plants are set, some of them, even in the most favourable seasons, are liable to die soon after the work has been performed; it is necessary in the course of a fortnight or three weeks to look over the ground, and put fresh vigorous plants in the places where the others have been destroyed. By this means the plantations may be rendered more perfect and productive.

*After-culture.*—Whichever method of planting is practised, it is of consequence to the success of the crop that it be kept perfectly clean from weeds, and that the mould be occasionally stirred about the roots of the plants. The first is accomplished by means of hand-weeding and hoeing, during the summer season; and the latter, either by the use of a hand-hoe or a light plough. This last is the most easy and expeditious. In this manner, or by digging the in-



ervals of the rows, the mould is also laid up to the plants once each year, after the stems have been removed in the autumn season. Where the bed practice is followed, they are sometimes earthed up in the autumn, after the stems have been cut down, by paring the intervals somewhat in the manner of those of the asparagus kind. This method is however, in general, too expensive and troublesome where the plantation is extensive.

The crops are to be managed in this manner until the third autumn after planting, when the plants will be in a state to be taken up. This is known by their stalks beginning to wither, and is generally about October. This business is performed either by trenching the land over with a spade, or by means of the plough. The first is the more certain though much less expeditious method. In executing it, the workmen dig along the rows to the depth of about two feet, breaking and reducing every spit of earth as perfectly as possible; each being attended by two persons who pick out the roots of the madder. But when the planting has been done in narrow beds, it is sometimes the practice to take the roots up, by turning the earth into the intervals by a *spud*, or broad three-tined fork. In this way it is supposed that the roots are taken up more perfectly, and with less danger of being injured. But the most ready method is by means of the plough, which, after having the earth-board and coulter removed, is passed along each side of the rows, so as fully to loosen the mould; persons being employed to pick out the roots, loosening such parts of the earth as may have escaped the action of the plough by their spades.

When the roots have been taken up, they should be exposed some time to the air, in order that they may be rendered so dry as to be cleared from the mould. They are then to be conveyed to a kiln, such as is employed for the purpose of drying malt or hops, where they are to be brought into such a state of dryness as to be perfectly brittle; this is done to prevent the danger of their being injured by becoming mouldy, or from running into a state of fermentation; but much caution is necessary in conducting the process. After this they are packed up in bags in order to be disposed of to the dyer, who reduces them into a powder, by a mill, before they are made use of as a colouring ingredient.

The best madder is that which, on being broken, has a brightish red or purplish appearance, without any yellow cast.

In order to collect the seed of the madder plant, it is necessary to let the plants remain in the field till the seed is almost wholly ripe, which is generally in the month of September; the heads are then to be separated from the stems, and exposed on a cloth in the sun till the seed can be easily forced out by slightly beating them. It is then to be rendered perfectly clean, and afterwards placed in a sunny situation until it is become quite dry; for if the least dampness remain it will grow mouldy, and its vegetative power be either greatly impaired or wholly destroyed. When thus properly dried, it should be put in small bags, and hung up to the ceiling of a room where a fire is constantly kept.

The produce from the root of this plant is different, according to



the goodness of the soil, but mostly from ten to fifteen or twenty hundred weight where they are suitable to its culture.

It seems probable that the cultivation of madder might be rendered a profitable article of field husbandry in different districts, if the importation of the root from Holland was prohibited; as the event of different trials has shown that full crops of good madder are capable of being raised. It is supposed by an intelligent cultivator, that if the price was never lower than three pounds the hundred weight, it might be grown not only with profit by the farmer, but without injury to the consumer.

From the high degree of culture which land under this sort of crop must necessarily undergo, and its not being so much exhausted as in many other cases, it must be an excellent preparation for wheat or any other crop that requires a clean and fine pulverised condition of the ground.

*Teasel.*—This is a plant of the thistle kind, which is cultivated in the field in some districts for its use in the dressing of cloths, the head being constituted of different well-turned vegetable hooks\*.

The soils most adapted to the culture of this plant are those of the more strong and deep kinds, but which are not too rich, as loamy clays, and such as have marley bottoms and are fit for the growth of wheat crops. If broken up from the state of old ley, it is the better; but wheat stubbles are sometimes made use of for the purpose.

The situations the most favourable are those that are rather elevated, open, and incline to the south. The high grounds, especially where the country is inclosed, are the most advantageous, as the natural superabundant moisture in the heads of the plants is more completely dissipated in wet seasons, which in other more low situations is apt to lodge so long upon them as to cause them to decay.

In the preparation of the ground when it is a ley, the best method is to plough it up deeply in the beginning of the year, as in the first part of February; and where it is inclined to the retention of moisture, this should be done in narrow ridges of about three bouts each, the furrow slices being laid as even and regular as possible, the fine mould from the furrows being raised by the plough or spade so as to cover the surface. But in lands that are sufficiently dry, and which are broken up from stubble, the ploughing may be deferred to a later period, and be laid in ridges of much greater breadths and more flat. In either case the surface should be left in as fine a state of mould as possible for the reception of the seed.

*Seed.*—In collecting the seed, it should constantly be taken from such plants as are the most perfect of their kind and the most productive in heads, as there is much difference in the quantity that is afforded by different plants, some producing nearly a hundred, while others do not afford more than three or four. It should be suffered to remain till it becomes perfectly ripened, and be used

\* It is the *Dipsacus Fullonum*, or Fuller's Thistle.



while fresh, as such as has been long kept seldom vegetates in a perfect manner.

The proportion of seed that is mostly employed on the acre is from one to two pecks, but some make use of a larger quantity. It is disadvantageous, however, to sow the seed too thick, as the plants are injured in their early growth by standing too closely together.

*Time and method of sowing.*—Crops of this sort are commonly put into the earth about the beginning of April. As the seeds vegetate in the most expeditious and perfect manner when put in while there is a considerable portion of moisture in the soil, the sowing should never be deferred much longer than this period.

It is mostly sown in the broadcast method evenly over the surface, in the manner that is practised with turnips. But before this is performed the land should be well harrowed down, in order to afford a fine state of mould as a bed for the seed. It is then to be covered in by a slight harrowing with a light short-tined harrow.

This sort of seed may likewise be sown in rows in the drill method, at the distance of eight, twelve, or more inches from each other, in the same way as that of the turnips. This method is not, however, much employed by those who are in the practice of raising teasel crops.

*After-culture.*—As much in the cultivation of crops of this kind depends on the land between the plants being kept perfectly clean and free from weeds; in having them set out to proper and sufficient distances; and in having them well earthed up, it is necessary that the cultivator should see that these operations are performed in a perfect manner. The digging between the plants is usually executed by means of spades which have long narrow bitts not more than about four inches in breadth, having the length of sixteen or eighteen inches. With these the land is commonly worked over in the intervals of the plants three or four times during the summer months; and about the beginning of November, when they stand too closely together, they should be drawn out, in order to fill up any vacancies that may have occurred. When there are still too many plants remaining, it is sometimes a practice to prepare another piece of ground, into which these are transplanted. It is, however, found that those plants which are never removed produce the best heads.

In the ensuing winter, as about the latter end of February, the land between the plants is to be again worked over by the narrow spades, care being taken that none of the mould falls into the hearts of the plants. And about the middle of May, when they begin to spindle, another digging over is given, the earth being raised round the root-stems of the plants, in order to support and prevent them from being blown down by the wind. Some cultivators perform more frequent diggings, that the ground may be rendered cleaner and more mellow; consequently the growth of the plants be the most effectually promoted. This business is commonly termed *spaddling*, and is executed with great dispatch by labourers that are accustomed to it; the use of the hoe has been attempted by some in performing it, but without success. After these diggings nothing



further is necessary till the period of cutting, which is generally about the month of July, which is known by some of the uppermost heads beginning to blow; as, when the blossoms fall, they are ripe, and in a state to be cut.

This is a work that should be performed as the heads become ripe; but is mostly executed at three different times, at the distances of about ten days or a fortnight from each other. It is done by means of a knife, contrived for the purpose, with a short blade and a string attached to the haft. This last is done in order that it may be hung over the hand. A pair of strong gloves is likewise necessary. Thus prepared, the labourer cuts off the ripe heads along the rows, with about nine inches of stem, and ties them up in handfuls with the stem of one that is more perfectly ripened. On the evening of the day on which they are cut, they should be put into a dry shed; and when the weather is fine and the air clear, they should be taken out, and exposed to the sun daily till they become perfectly dry. Much care must however be taken that no rain falls upon them. In doing this, some make use of long small stakes or poles, on which these handfuls are hung.

After being completely dried, they should be laid up in a dry room, in a close manner, till they are become tough and of a bright colour, and ready for use. They are then to be sorted or separated into three different kinds, by opening each of the small bundles. These are distinguished into *kings*, *middlings*, and *scrubs*, according to their different qualities. They are afterwards made into packs, which, of the first sort contain nine thousand heads, but when of the second twenty thousand; the third sort is of a very inferior value\*. By some before forming them into packs, they are done up into what are termed *staves*, by means of split sticks.

The produce in crops of this nature is very uncertain, there being sometimes fifteen or sixteen or more packs on the acre; and at others scarcely any. The produce is disposed of to the cloth manufacturers in Somersetshire, Wiltshire, and Yorkshire, and in general averages about forty shillings the pack. From the circumstance of the land being under the necessity of being kept in a high state of pulverization and cleanness, the expences of cultivation must be considerable. Mr. Billingsley makes them eight pounds four shillings the acre, the produce being fourteen pounds, which leaves a profit of five pounds sixteen shillings, the tythes and taxes not being charged.

This kind of crop is extremely precarious, as the plants, especially when the season proves wet about the time of blossoming, are liable to rot and be destroyed.

The uncertainness of teasel crops has induced the cultivators to blend other plants with them the first year, such as beans, &c. in order to repay them in some measure for the great expense of tillage and keeping the land clean: but this is a practice that should be avoided as much as possible, as the growth of the teasel plants must constantly be injured by it.

From the nature of the soil, the preparation that it undergoes in

\* Corrected Agricultural Report of the County of Somerset.



rendering it fit for the growth of the plants, and the fine state of pulverization and cleanness that is kept in by the after-culture which is necessary, it becomes well adapted for the reception of a wheat crop after the teasels are removed, and which may mostly be put in on one ploughing. But as the teasel robs the soils on which it is grown of a considerable portion of their fertility, as is evinced by its succeeding the most perfectly on lands that are newly broken up from the state of old sward; it may not be advisable to follow it by such grain crops, except when the grounds are very rich; but to interpose some sort of green crop, either of the bulbous-rooted or stem kind.

*Liquorice.*—This is a plant sometimes cultivated in the field for the sake of its roots, which are made use of for various purposes. It is a hardy perennial of the deep-rooted kind. The species mostly grown is the common sort \*; the roots of which are said to be more sweet and juicy than those of the others. An open situation is always to be preferred for this plant.

The soils most suited to the growth of the liquorice plant are those of the deep light sandy loams, as the goodness of the crops depends upon the roots penetrating to a considerable depth.

The preparation of the land is effected either by the spade or the trench plough; but the first is the more perfect method. In either way the ground must be well loosened to the depth of three feet or more, the autumn before the planting is intended; and a sufficient proportion of well rotted dung then intimately incorporated with the mould. In this state the land is to remain till the time of planting, when another stirring of the earth must be performed to the same depth, the mould being left as light as possible.

The land being thus prepared, it is necessary to provide a sufficient quantity of sets. These should be taken off from the sides or heads of the old plants, care being taken that each of them have one or two good eyes or buds; and that they be perfectly sound. They should be about ten inches in length.

*Time and method of planting.*—The best season for putting the sets into the ground is in the early part of the spring, as soon as the frosts are over, as about the latter end of February or beginning of March.

There are different methods of putting the plants in, some preferring the setting them on the plain surface, while others have recourse to small beds. On soils that are dry and porous, the first may be the most advisable practice; but in such as are retentive of moisture the bed method may be preferable.

In the first mode, the sets are usually put in by means of a line, with a dibble of considerable length, in rows at the distance of two feet from each other, and one foot or more in the rows; the shoots being put in straight downwards, so as to be covered over about one inch with earth on the top. Where the intervals between the rows are sufficiently spacious, there are considerable advantages in the cultivation of the roots, as the earth may be stirred and kept clean at

\* The *Glycyrrhiza glabra*.



little expense by means of the plough, and at the same time they will have room to attain a more full growth.

Where the planting is performed in the latter method, it is the practice in some districts to put the sets in on beds three feet in width raised into ridges. In both these methods, it is the custom with many to sow, at the time the planting is executed, some small seed-crops, such as onions. In the bed method they are sown in the alleys: but though in this way some advantage may be immediately gained, without much care in removing them from about the liquorice plants, they will be prejudicial to their growth: besides, they prevent the land, in the intervals of the rows and alleys, from being stirred and kept in a perfectly clean state, a circumstance on which much depends in the culture of the liquorice root.

*After-culture.*—It is highly necessary that the plants be kept free from weeds by repeated hoeing and hand-weeding during the summer months; and towards October, after the onions or other crops, where they are grown, have been removed and the land been well cleaned, a slight covering of well-rotted dung should be applied. In this state the plants may remain until the following March; when the ground between the rows, or in the alleys, must be lightly stirred, either by digging or the plough, in order to promote the growth of the plants. Some likewise advise the tops of the liquorice plants to be annually cut over. These methods are to be pursued till the third year after planting, when the roots will be in a condition to be taken up, but which should not be performed until the stems are wholly decayed, as when raised too early they shrink greatly and decrease much in weight.

The method of taking up the roots is generally by means of trench digging to the full depth of the roots, which is mostly about three spits in depth.

In executing the work three workmen generally follow each other with spits, beginning on the outside of the rows with the trenches, the last having a mattock to assist him in raising the roots. After the roots are taken up, they are thrown on the ground on the sides of the trenches. The same method is pursued with each of the rows until the whole crop is taken up. In some cases, the land in these trenchings is left in such a state as to be ready for replanting.

The small lateral roots are then trimmed off, the largest being cut into proper lengths for new sets, and the main roots tied up into bundles for the purpose of sale.

This sort of crop can only be cultivated in a local manner, as it requires land that has a great depth of soil, and which possesses considerable fertility. Besides, it is in some measure exposed to uncertainty, being liable to become rotten in wet seasons, and to be much injured in its growth by frost in the spring, and dry weather in the succeeding months. As the value of this root depends much upon its being kept in a succulent state, and there is considerable loss in weight by its being kept dry, it is the most advisable practice to dispose of the produce immediately after it is taken up; but where this cannot be done, it should be deposited in a moist situation till it can be sold.



*Lavender.*—This is a plant of the small shrubby kind, which is sometimes cultivated in the field, and found to afford a considerable profit in the spikes of flowers, which are made use of for being distilled for the purpose of lavender water. Near large towns, where the farmer has land that is suitable for its growth, and time to attend to such sort of culture, he should not forget it.

The soils most adapted to the growth of this plant, are those of the dry gravelly or loamy kinds.

In the preparation of the land it is essential that it be rendered perfectly clean from weeds, and brought to a tolerable state of fineness in the mould, in order that the plants may strike root and establish themselves more readily. It should be prepared by two or more good ploughings and harrowings in the autumn, and one more slight stirring before planting in the spring.

*Time and method of planting.*—The most proper season for performing this business is from the latter end of March to the beginning of the following month; at which time a suitable quantity of slips or cuttings of the young shoots should be provided according to the extent of land that is to be planted. These should be planted out by means of a dibble in rows at the distance of two and an half or three feet, the land being previously laid up into small ridges, and one and an half or two feet apart in the rows, the mould being very well closed about them. Some, however, prefer striking them in a rich shady border before they are set out in the field.

*After-culture.*—The plants should afterwards be kept perfectly clean and free from all sorts of weeds by repeated hand or horse-hoeing during the summer months, the mould or earth being laid up to the roots of the plants towards the beginning of the autumn. At this period the dead stems and leaves should likewise be cut and cleared away.

The plants mostly afford good spikes of flowers in the second summer after being planted out. They are fit to be gathered in June or the following month, and tied in small bunches to be sold to the perfumers.

A plantation of this sort when once formed lasts many years, only requiring the management mentioned above, and proper pruning so as to keep the plants in due order.

## SECTION XVI.

### *Cultivation of Arable Land.—Management of Grain, and other Crops.*

HAVING in the preceding section described the methods of culture that appear the most advantageous and proper in the different sorts of field crops, we shall now consider the different modes of cutting, harvesting, and securing which are in use, and that are the most economical and best adapted to those of the corn or other kinds.



*Cutting and Harvesting Grain Crops.*—The times and methods of cutting down grain crops, as well as those of harvesting and securing them, vary considerably in different districts, and under different circumstances and kinds of corn. In some, as those of the midland and more southern counties, the harvest commences early, as towards the latter end of July or beginning of August; and the grain is chiefly cut by means of short stiff scythes constructed for the purpose, with bows of small sticks, or what are sometimes termed *cradles*, fixed to the handles in such a manner as to deposit the heads or ears of the corn, as much as possible, in one direction. In this practice, the produce is frequently bound up into a sort of sheaves or bundles; while in cases where the naked scythe is made use of, the binding is but rarely attempted, the crops being merely raked together, and put in small heaps, till they are in a proper state to be secured in the barn or stack-yard.

But in most of the northern districts, and in Scotland, where the cutting of the grain begins at a much later period, as about the middle or latter part of August, the business is chiefly performed by means of the sickle or reaping hook; the handfuls, as soon as cut, being placed upon bands made by twisting a few of the stems together at the ear ends. These are mostly afterwards bound up into sheaves of different sizes, according to the nature of the situation and climate. Different machines have been contrived for accomplishing this tedious business, but we believe without being generally applicable to the purpose.

The manner of engaging men for the performance of harvest work is very different in different districts; in some it is the custom to agree with them by the acre for executing all the different sorts of operations which belong to it, such as those of reaping, or mowing, shocking, making, and carting to the barn or stack, as well as securing it in them. But in others this sort of labour is performed by the day, week, or month. In either method the greatest attention is necessary from the farmer to see that the different branches of the work be properly and seasonably executed, and that the men stick close to their labour. The expense of this sort of work has lately increased in a very considerable degree, as from four or five to ten or twelve shillings per acre, and in some districts much more.

In the above mentioned mode of cutting and binding the grain, it is mostly set up into what are provincially termed *stooks*, *stouks*, or *hattocks*, which is accomplished by setting six, eight, or ten sheaves together, with the tops or ear ends inclining against each other; after which the whole is capped, or covered over, by dividing two sheaves quite up to the bands and slipping them over the others, in such a manner as that their butt ends may meet in the middle, while the ear ends spread fully over the upright sheaves, and preserve them from the wet. These top sheaves, from the manner in which they cover the others, are termed *hooders*.

In almost every situation, both in the southern and the more northerly parts of the kingdom, the wheat and rye crops are however cut by the sickle or the reaping-hook, as it is scarcely possible to cut them with the scythe without considerable loss. And besides, it is of great



advantage, in respect to the straw, to have the crops bound up into sheaves in a regular manner. Sometimes a hook which is sharp on the edge, but without teeth, is made use of; the labourer, in performing the business, hooks up the grain towards him, cutting it very close to the ground. This is in some districts termed *bagging*.

In the cutting of grain crops, whether by the scythe or the sickle, there is much difference in different places, in the height at which the operation is performed. In some it is the practice to mow or reap the crops as close to the surface of the ground as it can be conveniently executed; but in others, eight, ten, fifteen, or more inches of stubble are left.

There are advantages and inconveniences attending the cutting of grain crops, both in the scythe and sickle method. The first has the advantage of being expeditious, and at the same time of being capable of being executed with any degree of closeness that may be required; but it leaves the produce in an irregular and uneven situation, which renders it not so fit for being bound up into sheaves. And besides, where the corn is very ripe, it may be more liable to be shed during the operation, when performed in this manner. It is, however, often the practice, where corn is cut by the scythe, to have it bound up into sheaves, as well as to let it remain in the swaths until it is ready for the stack; but where the former is the case, the grain is mostly mown inwards towards the crop, the cut grain resting against the standing corn; while, in the latter, it is cut outwards, and formed into swaths in the same way as with grass.

Where the sickle is employed, the crop is placed with more exactness and regularity, and of course is capable of being bound up with greater ease and facility. And it is probable that there is less loss of grain incurred in the operation. The business is, however, more tedious and difficult of execution in this way than by the scythe. It seems obvious therefore, that where labourers are scarce, the former method must be the most advisable; but where the contrary is the case, it may be the most advantageous to have recourse to the latter.

In regard to the height of cutting grain crops, as the stubble which is left in mowing or reaping them is not only nearly useless to the land, but frequently so troublesome in the culture of it afterwards as to be under the necessity of being removed; it would appear to be the best and most economical practice, in either case, to have them cut as close as the nature of the ground will admit. By this means the agriculturist will not only have more litter at command for the bedding of his yards, stalls, and other places, and consequently an increase of manure, but have the business more expeditiously performed, and with much less waste of the grain; and at the same time be freed from the trouble and expense of removing the stubble.

It has been shewn by careful experiment made with the view of ascertaining the difference between high and low cutting, that there is much advantage in favour of the latter mode. In this trial, four ridges in the same field, apparently equal in quality, were two of them reaped close by the surface of the ground, and the other two at some



height, though not so high as in the general practice of the district. Each of the portions was found to measure something more than a quarter of a Scotch acre, which is more than a fifth larger than that of the English statute acre.

The produce was then set up separately into *stooks*; and the length of time that eight reapers took to the part that was cut *low*, was found to be one hour and twenty-four minutes; and that taken up by the same number, in the part cut *high*, only forty-eight minutes. The expense in wages was eighteen-pence each the day, and that of maintenance six-pence. The result of the experiment on the grain being threshed out and measured, and the straw weighed, was found to be greatly in favour of low cutting.

In respect to the proper period of cutting the different kinds of corn, it is best shewn by the appearance of the crops, as when the grains are become plump and well filled, and the greenness in a great measure removed from the straw and ears by the bleaching effects of the oxygen of the atmosphere, it will in general be necessary to begin the business of cutting. It is, however, the best practice in most cases to begin before the crops are too ripe, especially when the scythe is made use of, as there will be less danger of waste. And the business should always, if possible, be performed when the crops are perfectly dry; as when cut down while wet, they are extremely liable to become mouldy, and injure the sample. Whether the scythe or sickle be made use of in cutting grain crops, it is probably the most judicious and safe practice to bind the produce up into sheaves. It has been remarked by an experienced agriculturist, that there are many advantages resulting from it: the waste of grain is much less; the crop is more quickly placed out of danger from the weather; the labour of carrying, housing, or stacking, is greatly lessened; the straw, in wet seasons, is much better for the purposes of cattle-fodder, and the grain preserves its colour far better. On the whole, it is likewise concluded that the quantity of labour is rather diminished than increased: besides, the business of threshing, especially where the work is performed by the machine, is thus rendered much more easy and expeditious.

The loose method of harvesting, if practised at all, can only be employed in the more southern districts, where the harvest commences at an early period, and where the climate is mild, regular, and steady, as there must under other circumstances be much danger from the crops being so fully exposed to the weather.

In the binding of grain crops, middling-sized sheaves are constantly to be preferred to those that are very large, as there is not only less danger of their becoming mouldy within, but they are more easily penetrated by the winds and dried by the sun. In tying the bands, care should be taken that they do not slip too much towards the ear ends of the corn; and that they be made sufficiently tight for the straw not to slide through them during the time of setting them up in the field, conveying them to the barn or stack, or in the operation of stacking; as, where this is not properly attended to by the workmen, there is often much trouble and inconvenience afterwards from the sheaves falling asunder.



Wheat and rye crops, as being mostly free from weeds and having the straw but little imbued with moisture. will only require to be exposed to the influence of the sun and air for a short time, as a few days, in order to render the grain plump, slippery, and a good sample. Much may be effected this way, by spreading out and exposing the grips, handfuls, or any small portions of the crops, as they are cut down, to the full action of such powers, turning them occasionally, and carefully binding them up before the evening dews fall upon them. A very little rain is capable of making these crops grow, and thereby injuring the value of the grain. It is generally the practice in these cases to set the sheaves up during the sunny parts of the day on their root ends, putting them into *battocks* during the night. In this way they soon become fit for the barn-or stack.

But in barley and oat crops as well as those of the pulse kind, a much longer time is requisite in the field to prepare them for being put up either in the barn or the stack. The necessary length of time will depend much upon the cleanness of the crops from any weedy or grassy matters. After being cut, they must remain, according to the manner in which the operation has been performed, for such a length of time in the field as is sufficient to render the stems of the grain, as well as any grassy material they may contain, in such a state of dryness, as that when closely stacked up they will take on little or no heat; as, where the contrary is the case, the grain is liable to be spoiled by becoming *mow burnt*, or greatly injured in the colour of the sample. Oats take much less harm in the field than any other sort of grain.

Where the grain is reaped by the sickle, the produce is often placed loosely upon the bands in the day, and tied up into sheaves towards night, being then set up into *battocks*. These, when the weather is fine, especially if the season be wet, are exposed to the action of the sun and air by taking off the hood, or cap sheaves, in the day time, carefully replacing them as the evening approaches. In bad weather the root ends of the sheaves are likewise turned up towards the sun. This practice when properly executed, so as that the sun and air may enter, is highly beneficial, and should not be neglected. Mr. Young also mentions a method that may in some situations be practised with advantage on the wheat crops, which is that of covering the shocks with mats. It is said to be employed in the neighbourhood of Sandwich and Dover with such benefit in improving the sample, that the bakers in the latter place give a decided preference to grain that has been managed in this way.

And in mowing corn crops, where they are afterwards bound into sheaves, a similar method is pursued in bringing them into a proper condition for being piled up in stacks. In executing the business it is usual for the mower to be followed by a woman and boy, the latter of whom prepares the bands, while the former with a long-toothed wooden rake having a short handle, collects the cut grain into parcels about the size of sheaves, depositing them in a quick easy manner in the bands, without stooping or touching them with her hands. The mower having proceeded to the end of the swathe, binds them up as he returns, placing them either upon their root ends, or setting them into *stooks*; and in the mean time the stubble is raked over by



the woman in so clean a manner that scarcely a stem is left; this is performed with much ease and expedition where the land has been well harrowed over and rolled at the time the crop was put in.

A reaping fork is sometimes made use of for collecting it into sheaves. This is constructed with two prongs below, somewhat in the manner of the common hay fork, to which are added at the upper part two upright prongs, by means of which the grain is removed from the swathe and collected into sheaves, the lower prongs rising it up, while the upper ones prevent its falling backwards, and determine the quantity which is proper for the sheaf. By this simple contrivance the grain may be gathered more regularly and much more expeditiously into sheaves than by mere hand labour. After the grain is become perfectly dry by exposing it to the sun and wind in the manner described above, it is put into the stack.

This method of cutting and harvesting grain would appear to be better than that of reaping, as being much more expeditious, and consequently reducing the number of labourers that would otherwise be necessary, and which in many situations are difficult to be procured.

The neatest harvest work is, however, made by the sickle, and it is probably the best method where a sufficient number of hands can be procured. The sickle with teeth should be employed in preference to the *reaping-hook*, with a cutting blade which is used in some places, as it is a much more expeditious and convenient tool, and performs the business in a much better manner.

Where the corn crops are cut by the scythe, and secured without being bound up into sheaves, the swathes are in some cases repeatedly turned over till they become sufficiently dry to be put into the stack; but in others, after being a little dried in the swathes, they are formed into a sort of heaps, or cocks, in which they remain till they are ready to be carried into the barn or the stack-yard. As soon as they have attained this state, they are conveyed as quickly as possible to the barn, or stack, a number of labourers being employed to rake over the ground. The method of harvesting grain crops in this case has much similarity to that pursued in the hay harvest. It is, however, a slovenly wasteful practice, which does not by any means deserve encouragement, as there must constantly be great hazard of securing the produce when the season is not favourable. Beans are always either reaped or pulled, but the former is probably the better practice. And all strong crops of peas should be hooked not mown, as is often the custom.

Besides these methods, when the harvest is late and unfavourable, and the difficulty of preserving the grain greatly increased, others are sometimes had recourse to, such as *gaiting* and *hutting* the corn. The first of these operations is chiefly practised when the crops are cut late and in a wet condition, and is performed by tying the sheaves in a rather loose manner in the usual place, and then slipping the hands up to the ears. They are afterwards set down on the ground on their root ends, in so forcible a manner as to give them a good basis to rest upon: with experienced labourers, the hand is then thrust down through the middle of the sheaves, by which the butt



ends are spread out and the central parts left open and hollow, more especially those that face towards the south ; as, by that means, the air and the rays of the sun enter and pass through more freely, from which the grain is better and more quickly preserved and rendered fit for the mow or the stack.

The *hutting* of grain in the field is mostly had recourse to in late wet harvests, and is a practice often attended with much success in the more northerly climates, especially when it can be accomplished while the corn is in a tolerable state of dryness, immediately after being cut and bound into sheaves. The huts are formed by building the sheaves together in such a manner as to shoot off the wet as much as possible, to the height that the labourer can reach as he stands upon the ground, being so narrowed up as that they may be covered at the tops by a sheaf or two, spread out so as to let the water readily pass away. They generally contain from about twelve to twenty *shocks*, in proportion as the straw is more or less bulky. When thus properly constructed, the grain may be preserved, however bad or long continued the harvest season may be. Grain managed in this way has been found, on the *buts* being taken down after they had been exposed to the most severe and heavy rains of the worst harvest seasons for five or six weeks, in an astonishing state of preservation, little injury having been done, except to a few of the top sheaves : while that in fields adjoining not treated in the same manner, though carefully set up in stooks and hooded, was completely grown and matted together, so that each stook was a connected mass of vegetable vegetating matter. This fact shows the advantage of the practice in the most clear and satisfactory manner, in districts where the harvests are protracted to a late period, and the weather on that account apt to be wet and unfavourable.

After the grain has been rendered, by some of these modes, perfectly dry and in a proper situation for the stack or mow, no time should be lost in carrying the crops. In performing the business, whether carts or waggons are made use of, the grain is mostly put upon them by labourers stationed in the fields for the purpose ; and after they have been brought home, are forked up to the stacks, &c. by the drivers.

Where this sort of work is on a large scale, and there are plenty of teams, some advise having three carts or waggons in employ : one loading in the field, another unloading, and one upon the road, for all of which five or six horses may be sufficient. In this way, with two men to pitch, an equal number to load and unload, and one to drive the teams, much work may be quickly dispatched. Others, however, suppose that one-horse carts have a great superiority in executing this sort of farm work.

The wheat-crops are in many districts chiefly preserved in the barns. This is particularly the case in the midland and south-easterly counties, where they are large ; but in various other parts it is the practice to build this sort of grain, as well as those of barley, oats, peas, beans, &c. into stacks in yards contrived for the purpose. This last method, when properly performed, is probably the best and most convenient, as the grain is not only more secure from vermin,



but preserved much more free from mustiness, and at the same time capable of being got at with more ease and facility.

Wheat is likewise found to “carry a finer countenance” out of a stack than the barn; the free admission of air is supposed to give it a brighter colour.

There are however in this way some inconveniences in getting in the stacks for being threshed in the barn, as it is dangerous to leave broken ones out, or to take them in when the season is wet. But it has been well observed by Mr. Young that the business of stacking corn “must receive an entirely new arrangement in the case of building a threshing mill; By means of no other additional expense than that of an iron rail-way, and placing the stacks on frames resting on block wheels, two feet diameter, a very considerable annual expense in labour may be saved in carting stacks to the barns, in loss of corn, and in waiting for weather, as well as in the saving of threshing by flails, and all the attendant evils of pilfering and leaving corn in the straw.” It is a point of great importance, and should therefore be particularly attended to.

In the reaping of crops of turnip, cole, and other similar sorts of small seeds great attention, care, and exertion is necessary to guard against losses that must otherwise inevitably take place. No time should on any account be lost while the weather is fine in getting the work forward, as these sorts of crops should be conveyed to the threshers as fast as they are reaped, and not placed in houses or stacks. In performing the business of reaping it is necessary for the labourer to bestow much attention in order to avoid shedding the seed; and similar care is requisite in removing the reaped crop to the threshing place. The best method is probably by the use of small trucks or carriages moving on low wheels with poles and cloths strained over them, as they come cheap and are extremely convenient. The turnip or rape is lifted up gently and deposited in them at once so as to prevent any loss; being afterwards immediately conveyed to the threshing-floor. In this way the work proceeds in a regular and expeditious manner.

*Stacking of Grain Crops.*—It is a common practice, when grain is secured in stacks, to allow it to be deposited upon a basis formed of large pieces of timber or other kinds of wood, and filled up in the middle with brush-wood faggots, or any other materials of a similar nature, a little straw litter being thinly placed over the whole. This is, however, a dangerous and slovenly method, that ought never to be attempted by the correct agriculturist. It is a much safer, better, and upon the whole a more economical practice, where this mode of preserving corn is in use, to have the stacks built upon frames constructed of wood, stone, or brick. When constituted of the first sort of materials, they are usually raised upon stone pillars or supporters, to the height of from two to two feet and a half, the tops being cap or covered over with flat round stones of considerable dimensions, so placed as to prevent the entrance of vermin. But when made with stone or brick, they are built to the same height as in the former case, in a rather slanting manner outwards, and covered on the tops with copings of oak planking or flat



stones, which project over the edges several inches, and in that way prevent the depredations of rats and mice on the grain, as well as their lodging in the stacks. In both cases pieces of timber are placed as a frame in the middle to support the grain.

The first of these sorts of *corn-stands* is in general the best, as being more easily as well as more cheaply constructed, and at the same time permitting the air to enter and circulate with more freedom underneath, in the bottom of the stand.

In respect to the form of these stands, it varies according to that in which the stacks are made, which is different in different districts. The circular and oblong forms are the most usual; but the long narrow shape is probably to be preferred, as it is said to keep the corn better, more dry, and free from heating.

It is an advantage in this sort of stands that the crops, especially those of wheat, may be carried and stacked upon them much sooner after being cut than in other circumstances. They have likewise the advantage of preserving the grain in a more sweet condition, when kept till the following summer, or for a greater length of time.

Though very different forms are in use in building corn stacks, those of the long, narrow, square shape are probably the most advantageous where the quantity of grain is considerable; as they stand more firmly, have a better appearance, are more conveniently built, and preserve the corn better than those of other forms. Besides, they require less thatch as well as labour in putting it upon them. But where the grain is only in a small proportion, the round or oblong shape may be more proper and suitable, as being more readily drawn up in the roof. The circular with a conical top and cylindrical body, diverging a little at the eaves, is esteemed the best form, by some.

In the building of the stacks the stems should be suffered to swell outwards, in a very gradual manner, quite up to the eaves, and not be brought up in a perfectly upright or plumb method, as is the case in some districts; as by this means they will not only be more effectually secured from the penetration of moisture, but require a less extent of stand. And if well built, they stand with equal firmness and solidity. The proportions that ought to be preserved in their construction, are in general about two-thirds of the whole, or something more, for the stems, and one-third for the roofs; but the difference of form may admit of slight variations in these respects.

The sizes of stacks of this sort must of course vary considerably according to circumstances; but they should never be made too large, as there is a great deal more risk in securing and getting in the grain for them; and from their being built at different times, they do not settle all together in so perfect a manner, or resist the effects of the weather, and keep the grain so well as those of less dimensions, that can be completed at once. Besides, they are more inconvenient in threshing out, especially where the flail is employed. The only advantages they possess are those of taking something less in thatch and labour in covering them. In general, from about twenty to thirty two-horse cart-loads may be sufficient for one stack.



Where grain is stacked loose, in the manner of hay, it is the common practice to have several persons upon the stack as for hay, the corn being forked up and placed on the sides all round in a similar manner; after which other parcels are laid round on the inside of these, so as to bind them in a secure manner from slipping outwards; proceeding in the same way till the whole middle space is well filled up; when the operator commences another course in the same method, and goes on in this mode, course after course, till he has formed the whole of the stem; when he begins to take in the roof, in a very gradual manner, in every course until he brings the whole to a ridge or point, according as the stack is formed. In order that the roofs may throw off the water in the most perfect manner, they should be suffered to have a slight degree of fulness or swell a little about the middle, and not be made flat, as is frequently the case.

But where the corn is bound into sheaves, seldom more than one person is employed in performing the business of building the stack, except where the dimensions are very considerable; in which cases it is found necessary to have a boy to receive the sheaves from the pitcher, and hand them to the man who builds the stack. In executing this work it is of the greatest importance that the centre of the stack be constantly kept in a somewhat raised state above that of the sides, as by this means the sheaves have a sloping direction outwards, by which the entrance of moisture is more effectually guarded against. To accomplish this in the most perfect method, it is the best practice for the operator to begin in the middle of the stand or staddle, setting the sheaves together, so as that they may incline a little against each other, placing the rest in successive rows against them till he comes to the outside, when he carries a course of sheaves quite round, in a more sloping manner than in the preceding courses. Having thus formed the bottom of the stack, it is afterwards usual to begin at the outside, and advance with different courses round the whole, placing each course a little within the other, so as to bind them in a perfect manner, till he comes to the middle. Different courses are to be laid somewhat in the same way, till the whole of the stem is completed; when the last outside row of sheaves is, in some cases, laid a very little more out than the others, in order to form a sort of projection for the eaves. Where the stem of the stack is however formed in the manner advised above, this may be omitted without any inconvenience, as the water will be thrown off without touching the waste or the stack. The roof is to be formed by placing the sheaves gradually a little more in, in every course, till it comes to a ridge or point, according to the form of the stack. In making this part of the stack, great care should be taken to give the ear-ends of the sheaves a sufficiently sloping direction upwards, in order that they may be the better secured from wetness. And the outside should be well rounded, in the manner that has been directed above.

Where proper attention is bestowed in building corn-stacks in this way, every sheaf in the whole will have such a sloping position outwards of the stack, or towards the root ends of the sheaves, as will afford the most perfect security against damp and moisture.

In stacking wheat-crops, these directions require more particular



attention; as the sheaves should have a rather more sloping direction when placed in the stacks, on account of the tallness of the straw, in order that they may be the better secured against the injurious effects of damps.

It is of much convenience and advantage, in the stacking of grain as well as hay, to have a large sheet or sail-cloth to place over them in case of showers or bad weather, while they are building, and before the thatch is put on; as where this convenience is not at hand, much injury is frequently sustained at these times by the sudden falling of rain.

It is the practice in some districts, especially where the stacks are made of a circular form, and the weather is wet and unfavourable, to have a funnel or chimney left in them, in order to prevent their taking on too much heat. This is effected by tying a sheaf up in a very tight manner, and placing it in the middle, on the foundation of the stack, pulling it up occasionally as the building of the stack proceeds all round it. And in setting up ricks in bad harvests, it is a practice in some places, particularly with barley crops, to have three or four pretty large poles tied together, by winding straw ropes round them, set up in the middle, round which the stacks are then built. Where grain stacks are not placed upon elevated frames or stands that are open in the bottoms, it may be useful in some cases to leave one or more openings in the lower parts of the stacks, that there may be a free circulation of air underneath them. But except the stacks are large, or the grain when put into them in an imperfect condition, such openings are quite unnecessary.

It may likewise be useful, in building large corn ricks, to have a *stacking stage* so contrived as to be capable of standing close to their sides, and by that means enable the workman to pitch the sheaves with more ease and convenience to the persons employed in forming the stacks. An easy contrivance of this sort is described in speaking of the methods of stacking hay.

*Thatching of Grain Stacks.*—In the thatching and trimming of corn-stacks, considerable experience, ingenuity and art are necessary, in order to perform the business in a complete manner. The most suitable material for the purpose is good wheat straw that has not been much bruised in threshing out the grain. But when this cannot be had in sufficient quantity, rye-straw may be substituted in its place; which, however, from its rough and stubborn quality, is neither so neat in its appearance, so durable, nor affords so secure a covering. Barley and oat straw are sometimes made use of for the purpose; but they form very indifferent coverings, and such as are not by any means lasting.

There is still another material that may be made use of with propriety and advantage in some situations. This is the stubble of such wheat-crops as have been cut at a great height; which, after being mown close to the ground and raked up, serve the purpose very well.

In preparing these substances for application, after being well moistened with water, they are drawn out in handfuls perfectly straight and even into regular lengths, and the short straw separated, leaving them placed in convenient bundles to be carried to the thatcher.



In the application of the thatch, different methods are pursued according to the nature of the materials employed. When long straw is made use of, the operator usually begins at the eaves or bottom of the roof, depositing it in handfuls in regular breadths till he reaches the top, the different handfuls being so placed endways as to overlap each other, the upper ends being constantly pushed a little into the bottom parts of the sheaves. In this manner he gradually proceeds, breadth after breadth, till the whole of the roof is covered, which is usually done to the thickness of about four or five inches. And in order to retain the thatch in its place, short sharp pointed sticks are occasionally thrust in, in a slanting direction upwards, and sometimes small sticks sharpened at the ends are bent and thrust in along the top parts and sides. But as the water is apt to follow the course of the sticks, it is a better practice to make use of ropes of twisted straw for this purpose. In some cases these are applied only round the bottom parts of the roof and the sides; while in others, which is a much better and more secure method, they are applied in such a manner over the whole stacks as to form a sort of coarse network nine or twelve inches in width in the meshes; the ends being well fastened, either to belt ropes passed in suitable directions for the purpose, or to different parts of the straw of the stack. This method of tying on the thatch should constantly be practised where the stack-yards are much exposed to the effects of the wind, as without such precaution great injury may frequently be sustained.

Where stubble is used in the way of thatch, it is put on by sticking one of its ends into the roof of the stack, in a regular and exact manner, so as that it may stand very close and thick: the other, with such loose straws as may occur, is then cut over, or pared off with a very sharp tool, for the purpose, so as to form a neat and impenetrable thatch, having the appearance of a newly thatched house. It is well secured in its place by short pegs made for the purpose.

In whatever way the thatching of corn-stacks is performed, it should never be attempted until they have fully settled; as where the contrary is the case, it is sure to rise into ridges afterwards, and by that means admit the water to pass down into them.

The expense and trouble which attends the thatching of corn-stacks has been brought as an objection by some against the practice of setting grain up in that method; but it is not by any means necessary, in order to have them neat and secure, to bestow either so much labour or materials upon them as to justify such an objection, though it may be done in some instances. As they are seldom designed to stand for any great length of time, it is quite sufficient that they be thatched in such a manner as to effectually prevent the entrance of water, and so secured that the winds cannot disturb them. To have the work performed in any other way would be totally incompatible with that dispatch which is constantly requisite at such seasons. Narrow oblong ricks rounded at the ends possess many advantages, both in the economy of labour and thatch, over those of other forms that have the same contents: besides, they admit of the thatching being performed at one end before the other is finished, or as the stacking proceeds.



But in any case the expense of thatch is of no great importance, as, when removed from the stacks, it serves very well as litter for the cart-horses and other cattle. And even barley, or oat-straw will answer the purpose perfectly well when drawn in an even manner and put on with sufficient care.

In districts where the stubble is left high, it may likewise be employed as thatch for grain-stacks, as has been already seen. But when it is intended to make use of it in this way, it should be mown as close to the ground as possible immediately after the corn has been removed from the field, being then raked together by means of a large *barso stubble-rake*\*, and carried to the farm or stack-yard in order to be put up in a sort of stack for future use.

When not applied as thatch, it may be made use of in the way of litter for the cattle stalls and fold-yards with great advantage. The practice of collecting it from the fields should therefore be constantly attended to as much as possible, as other sorts of straw may be saved thereby, and at the same time much manure produced.

In regard to the methods of trimming grain-stacks after they have been set up and thatched, they are differently performed in different districts. In the southern parts of the kingdom, where the injudicious practice of housing grain loose frequently prevails, it is an useful mode to pare or cut the outsides of the stems of corn-stacks in an even neat manner, by means of a sharp hay-knife or some other sharp tool. In this way the rain is more effectually prevented from being absorbed or taken into them along the loose straws. But where the grain is cut by the sickle and bound up into sheaves this is unnecessary, if the operator take sufficient care in building the stacks. In this, as well as the preceding method, it will, however, be advantageous to have the thatch evenly cut round the eaves and other parts where it may project, as the rain will thereby be less apt to fall against the bodies of the stacks in bad weather, and at the same time give them a neater appearance.

*Threshing of Grain.*—In threshing out grain different methods are pursued. The wheat-crops, in some districts where the straw is much used for the purpose of thatching farm buildings, is lashed out over a strong wattled hurdle, stone, or other similar contrivance. In other cases, this as well as all the other crops are threshed out by means of the flail or the threshing machine.

The flail method, from its being an extremely slow, tedious, and expensive process, and at the same time one that requires a great number of labourers, can, perhaps, only be practised with advantage on the smaller kind of arable farms, that are cheaply situated in respect to the command of workmen, and where the expense of large machines would be much too great for the quantity of grain which they produce. But even in these cases, if the small hand threshing-engines that are constructed on cheap simple principles, and which occupy but little room, should be brought to perform the business in an easy, expeditious and effectual manner, which seems not improbable from the improvements that have been recently made in this sort

\* Section on Implements.



of machinery, it will most probably be to the advantage of such farmers to abandon it, as the saving in various ways must soon repay them the expense of the machines, and at the same time afford them a considerable profit.

Besides, where the threshing is performed by the flail, expensive barn-floors, either of the fixed or moveable kind, will constantly be necessary. The latter sort may, indeed, sometimes be capable of being converted to other purposes. In this way too the produce is constantly exposed to the depredations of the persons that are employed in executing the business, which in many cases proves a source of great loss to the farmer, as he cannot by any means prevent the impositions to which it is liable. It has been well observed by the intelligent surveyor of a southern district, that where threshers are employed by the day, they frequently do not perform half the work that ought to be done in the time, nor even that in a perfectly clean manner; and, that if it be executed by the quarter or the truss, the freest corn is threshed out and the rest left in the ear. The same thing takes place in a greater or less degree in every other method that can be adopted for having the threshing performed by the hand; it is consequently only by the general introduction and use of the threshing machine, that the property and interest of the farmer can be fully secured, and the work be executed with that degree of economy which the greatly increased price of labour demands.

The superiority of the method by machinery over that of the flail is very considerable in many other respects, besides those of its executing the work in a much more clean and perfect manner, and with infinitely greater dispatch, so as to admit of the farmer being present during the process. Sufficient supplies of both corn and straw may at any time be almost immediately provided, either for the purposes of seed, the market, or the feeding of animals, without the other operations of the farm being in any degree interrupted. It is likewise obtained with much less waste of the grain, and with less danger of its being injured by being bruised.

From the increasing scarcity of labourers, the great advances in the price of labour in all the well-cultivated districts, and the impossibility of having this sort of work performed in a clean manner by the flail, the necessity as well as utility of these machines seems established. The principal obstacles to machines of this nature being more generally made use of, are chiefly those of expense in their erection, and the slovenly practice which prevails in some of the more southern districts, of securing grain crops in a loose manner. The first of these objections may probably, however, be obviated by the construction of hand threshing-engines; and the latter by the discoveries and improvements that are daily taking place in this sort of machinery. The objections that have been raised against the practice, on the score of its depriving labourers of employment during the winter season, are scarcely deserving of notice, as experience has fully shown that no injurious consequences can result from it, as there must always be work enough of other kinds at such periods, where farms are under a judicious mode of cultivation. And the inconveniences that may attend the largeness



of the quantity of straw that must be at once produced in this method, may be easily obviated either by placing it immediately in close stacks, or by having a part of it cut into chaff and laid up in a well-ventilated granary, as, in this way, there can be little doubt but that it will keep well, provided the operation has been performed while the straw is dry. Besides, by the use of one-horse or hand-machines the work may proceed without this trouble, as the straw is wanted for the uses of the farmer, which, in the case of store cattle being fed with it, may be a more advantageous practice. But where the fold-yard and cattle-stalls are kept littered, and as frequently changed as may be necessary for promoting its conversion into manure, the farmer will seldom be much incumbered with straw.

The saving of expense in this mode of threshing, over that by the flail, must be different according to the nature of the machine and the power by which it is wrought, as well as the state and condition of the grain, and the regularity with which it is supplied. By some it is stated as about one half, while others make it much less than that proportion. With the best constructed machines we apprehend it will be performed, on an average of different sorts of grain and different states of them, at one-third the expense of the flail method, or, perhaps, much less, without taking into the consideration any thing for the great saving in grain or the other operations that may be performed at the same time, such as those of winnowing or cleaning the corn, cutting straw into chaff, bruising and grinding the grain for cattle-food or other uses.

Where threshing machines are made use of, it is advised by the writer of the Agricultural Survey of the West Riding of Yorkshire, that the barns in which they are erected should extend into the stack-yards, as by that means the machines are more conveniently supplied, and at much less expense of labour, with the grain in the straw. These threshing-engines should likewise be adapted to the size of the farms, as by proper attention in this respect much expense may frequently be saved.

In threshing corn by the flail it is the practice in some districts for only one person to be employed upon a floor: but as two can thresh together with equal if not greater expedition, it must be an uneconomical and disadvantageous mode. But where more than two labourers thresh together, which is sometimes the case, there must be frequent interruptions, and a consequent loss of time. The tool by which this sort of business is performed should be well adapted to the size and strength of the person who makes use of it, as when disproportionately heavy in that part which acts upon the grain, it much sooner fatigues the labourer, without any advantage being gained in the beating out of the grain. The best method of attaching the different parts of the implement together is, probably, by means of caps and thongs of good tough leather: iron is however sometimes employed. In threshing most sorts of corn, but particularly wheat, the operators should wear thin light shoes, in order to avoid bruising the grain as much as possible. In the execution of the work, when the corn is bound into sheaves, it is usual for



the threshers to begin at the ear ends, and proceed regularly to the others, then turning the sheaves in a quick manner, by means of the flail, to proceed in the same way with the other side, thus finishing the work.

When much threshed grain has accumulated on the threshing-floor, it is necessary to separate the short straw and chaffy matter from it, by passing the whole through a wide riddle or sieve for the purpose. This should always be done before too much grain has been collected, as in that way the bruising of the grain may be more effectually prevented. The short chaffy substance thus separated is in some districts termed *cavings*, and is capable of being employed with advantage in the feeding of horses or neat cattle. After this has been accomplished, the loose grain should be thrown up to the sides of the floor, or, what is better, into a chamber conveniently formed for its reception, where it should remain till a sufficient quantity has been collected to render the clearing of it by the winnowing machine or other contrivance necessary.

It is almost impossible to ascertain the quantity of grain that a labourer can thresh out in the course of any given period of time, as it is obvious that much must depend on the nature of the grain, the freeness with which it threshes, and the exertions of the labourer: in general it may be of wheat from one to one quarter and a half; of barley from one and a half to two quarters: of oats, mostly about two in the day. The exertions of labourers in this sort of work in the northern districts of the kingdom, are however much greater than in those of the south: of course a much larger proportion of labour must be performed. In some places it is the practice to thresh by the measure of grain, as the bushel, quarter, &c. while in others it is done by the threave, of twenty-four sheaves, and in some by the day. In Kent, before the late rise in the price of labour, it was usual to pay from two shillings and six-pence to three shillings the quarter, for the first of the above sorts of grain; two shillings the quarter for the second; and one shilling the quarter for the third. And in the midland and northern districts the prices are nearly the same, or perhaps a very little lower in the latter. In the above county beans are likewise threshed at one shilling the quarter, and peas from one shilling and six-pence to two shillings the quarter. But in whatever way the farmer has this sort of business executed, there is always much necessity for his constant inspection, in order to prevent the frauds and impositions that are too frequently practised.

All sorts of grain and pulse, when the straw is intended to be made use of as cattle fodder, should only be threshed out as the straw is consumed, as it is eaten much better, and is more nutritious in this fresh state than when given them after it has been laid by some time after being threshed. And the same is the case with the *caving-chaff* or other material separated from the grain.

The grain as soon as threshed out should constantly be cleaned from the chaff and other extraneous matters, as by delay in this respect the sample is liable to be much injured. There are different methods of having this business performed; the best is probably by means of the improved *winnowing* machines, as the work is exe-



cuted in this way in a very cheap perfect manner, and at the same time with much ease and dispatch.

In some districts it is however the common practice to have the grain cleaned by means of the *casting-shovel* and flat broom, which is denominated a *spry*, which serves the purpose of sweeping off the chaffy materials and the small portions of straw that are detached by the wind from the corn. Where the barn-floors are sufficiently large in all directions, this mode of clearing grain is conceived by some to be the best and most expeditious, but that where the room is confined, winnowing machines will not only do the work better but perhaps at a more cheap rate. The other methods of rendering grain clean by exposing it to the action of the wind, on the threshing-floor of the barn, or before the sails of a machine, though practised in some districts, are so imperfect and troublesome as to deserve no attention from the enlightened agricultor.

Where the corn is cleaned in the first of the above methods, there is in most of the improved machines of the *winnowing* kind a screen through which the grain passes after it has been cleaned from the chaffy substances, and by which the small seeds of all sorts, as well as other foreign matters, are readily separated from the corn. This process is particularly necessary with wheat and barley. And if these grains be cleaned without the *winnowing* machine, it will of course be requisite to let them through a corn-screen afterwards, in order to remove any small seeds they may contain, as well as the ova of different sorts of insects, by which the production of the weevil, moth, beetle, &c. is prevented; and the depredations which they commit, while in their vermicular state, on different sorts of grain, effectually obviated. Implements of this nature may be had separately, but the business is much more conveniently and cheaply executed at once by the winnowing machine.

*Preserving of Grain.*—After the grain has been thus rendered clean, it is in a proper condition either to be sent to the market, or for being laid up in a state of preservation. As the prevention of all sorts of corn from being affected by the different causes that have a tendency to injure it, when laid up for the purpose of keeping, depends upon its being put by in a perfectly dry condition, and on its being afterwards preserved in that situation,—in order to effect these objects in the most perfect manner, it is of the greatest importance to keep the corn, from the period of its being threshed out of the straw, as much as possible from coming in contact with earth, stone, or other sorts of floors that are placed near to or upon the ground, as they have constantly much disposition to communicate moisture, and by that means greatly injure the grain. And another method is by preventing the entrance of the atmospheric air as much as can be done, whenever it is in a heavy damp state, by being too much loaded with humidity; as in this way, from the vast extent of surface that is exposed to its influence, it is subject to be very much damaged, the large quantity of moisture thus imparted to the corn bringing on a sort of mouldiness, which is attended with a musty disagreeable smell that lessens its value in a very considerable degree, as well as prevents its keeping.



The chief remedy in the first case, is by cautiously avoiding the too common practice of permitting the grain to remain upon the threshing-floors, especially those of the earth or stone kinds, after it has been threshed out, before being cleaned from the chaff; or, after being cleaned, by depositing it upon them either in a loose state or when put up in sacks. A perfectly dry room or bin should constantly be provided for its immediate reception, the business being performed as much as possible in a dry state of the atmosphere. And in the second, a great deal may be accomplished by means of proper slides, shutters, or other suitable contrivances being conveniently fixed in the pipes, funnels, or other openings intended for the purpose of ventilation, in the corn-rooms or granaries, which should be kept closely shut up whenever the atmosphere is so much charged with moisture as to prove detrimental to the grain.

And as frequent turning or stirring the grain, and ventilation, are found by experience to be essentially necessary for preserving and keeping it perfectly sweet and fit for sale, it is obvious, on the above principle, that this should only be attempted when the weather is fine, or the air in a dry elastic state. In damp weather, or when frost prevails, it should be excluded as much as possible. Besides air, light is likewise advantageous in the preservation of corn, under similar circumstances, as, without its being admitted, a sort of vegetable mucor, usually denominated mould, is apt to fix upon the grain and produce much mischief, at it is said to possess the same property as that of other funguses, of growing where there is scarcely any change of air, and in situations where there is little or no light, provided there be a suitable degree of warmth and moisture. On the same principle, with the intention of retaining the grain in a state as free as possible from dampness, it might be useful to have well-constructed stoves in the bottom parts of corn chambers or granaries, for the purpose of occasionally communicating such moderate degrees of heat to the grain as would be sufficient to dry up and expel any injurious moisture, that it might have attracted in damp wet seasons. On this ground it has indeed long ago been advised on the basis of experience, by an intelligent writer, to preserve wheat by exposing it to the action of a sunshine degree of heat, on a hair cloth in a malt kiln, produced by the combustion of clean straw, for such a length of time as may be necessary to remove the dampness; as from four or five to ten or twelve hours, according to the proportion in which it may exist. In this method the heat should always be kept so moderate as not to destroy the vegetative property or life of the grain; as by that means its putrefaction and decay would be promoted. The degrees of heat that would be the most calculated to answer the purpose in different cases would be easily regulated by those instruments that are in common use for measuring the heat and moisture of the atmosphere.

The principles advanced above, assist us in reconciling the differences of opinion, that have so long prevailed in respect to the use of air in the preservation of corn in granaries; as they suffi-



ciently shew that when admitted in its perfectly dry and elastic state, it must be particularly useful in carrying off any moisture or disagreeable smell that the grain may have contracted by remaining closely heaped together for some length of time; as by the stirring which mostly accompanies the ventilation it must operate in a very extensive manner; but that when applied in its moist heavy state, it must be detrimental in an equal proportion, by imparting its humidity to the corn, and by that means causing it to become musty.

The ventilation of grain should consequently be performed when the weather is fine, but never when the air is in a damp condition, or in the time of frost. This is the most completely effected by stirring the corn by proper slides or other contrivances in the floors, windows, and other openings in the granaries or corn-rooms\*: but it may be accomplished in a more slow and of course in a more uneconomical manner, by shovels, rakes, or other similar tools. But in order that this operation may be more readily as well as more perfectly executed, the grain should never be spread too thickly over the floors of such granaries or store rooms. From one to two feet or two feet and a half in depth, in proportion as it gets more dry and free from moisture, is fully sufficient for the purpose; as from the natural moisture of the corn when heaped together to too great a thickness at first, it is sometimes apt to take on too much heat, by which the quality or sample is greatly injured. Soon after its being deposited, frequent screening should also be practised, and afterwards occasionally according to circumstances. There are likewise other circumstances to be attended to, by which the due ventilation and preservation of the corn is much influenced, such as those of having the doors, windows and other principal apertures of the buildings placed towards the south, and as close to the ceiling as may be, so that the rays of the sun may enter as freely as possible. Besides, the linings of such corn-rooms should always consist of materials that have not a tendency from their coldness to precipitate the moisture from the atmosphere, which is often the case when warm damp south-west winds take place after cold north-east ones, and in that way impart it to the corn that comes in contact with them. In every case the prevention of the entrance of wet or moisture should be effected by sheltering boards, slides, or other similar contrivances.

Some management in the turning or stirring of the grain is also requisite, in order that ventilation may take place in the fullest and most complete manner. When the grain is first deposited and possesses much natural moisture, it should be much more frequently turned over, than afterwards when it has acquired a greater degree of dryness. Once or twice in every week or ten days may be requisite the first month: afterwards, for four or five months longer, about once in the fortnight may in general be sufficient; and after



that period only once in the month, except when the season proves very moist and warm.

In some places empty spaces are left on the sides of the heaps of corn and other parts, into which they may be turned over when necessary. But in others, square holes are formed in the ends of the floors, and round ones in the middle, by which contrivances the grain is thrown from the upper to the lower chambers, and back again, by which it becomes more agitated and exposed to the air. This method is practised in some parts of Kent.

As such frequent turnings in these methods are extremely troublesome and expensive in being executed by the shovel, sliding shutters have been contrived in the middle of the different floors which have an inclination towards the centre of the granaries, by the occasional removal of which, and the opening of the windows and ventilators, the grain is turned and ventilated at the same time with great facility and convenience. Monsieur du Hamel has found this mode of preserving grain to answer extremely well, even in cases where it was laid up in a moist state.

But grain may be preserved without having recourse to the process of ventilation, by having it deposited, when in a perfectly dry state, in such dry deep wells, pits, or other situations below the surface of the ground, as that it cannot be affected by heat, or the changes that take place in the season. But though corn has been known to have been preserved in this method for a great length of time in countries where it is the practice to store it up for times of scarcity, it is not by any means so safe or so convenient a mode as the former.

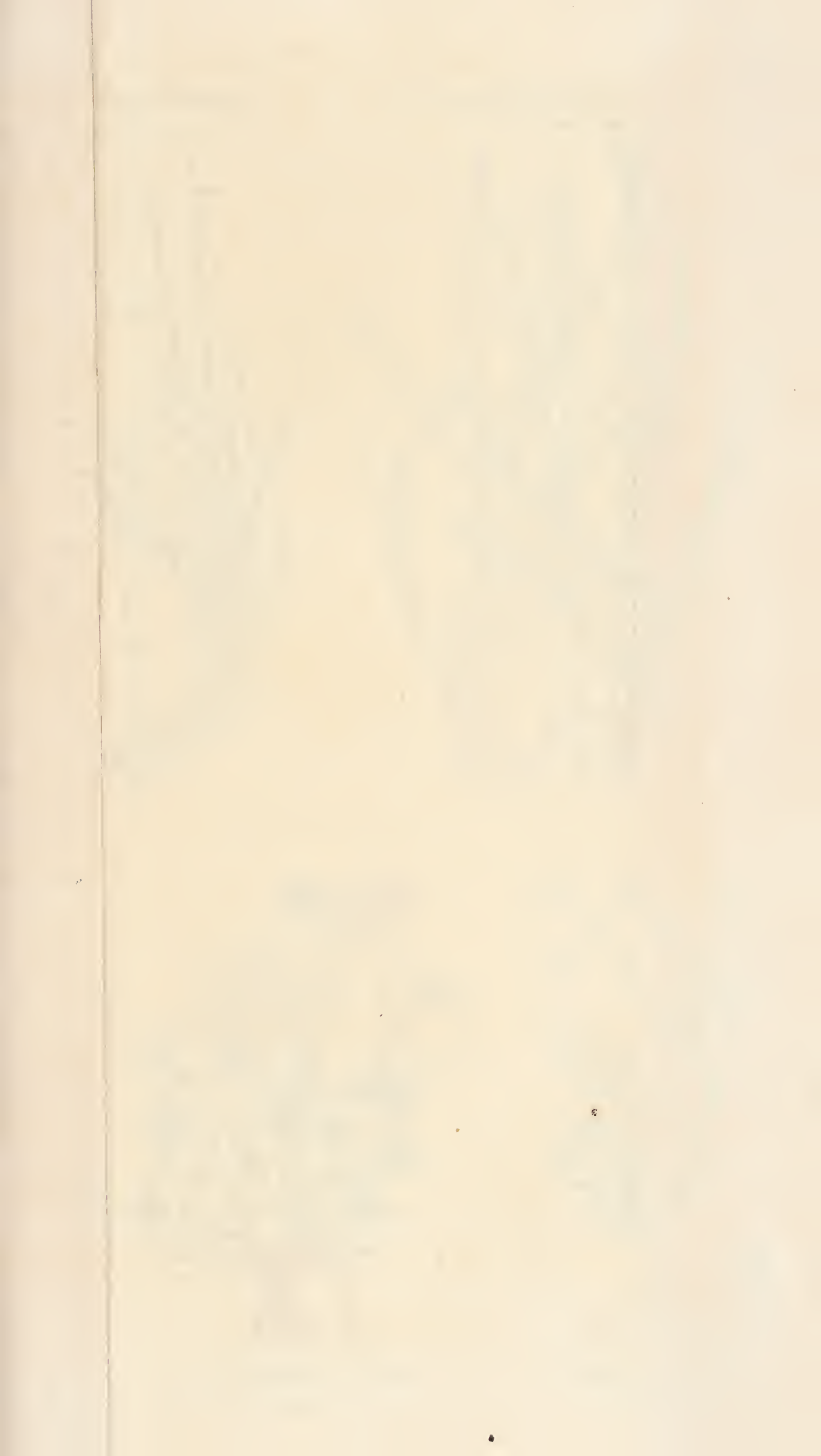
In whichever method corn is secured, care should be taken that such as is moist, or has been badly harvested, be not laid up with that which is dry and in a perfectly sound condition; as from the quantity of moisture that it contains, and the state of germination that takes place in consequence, a musty bad smell is apt to be imparted to the whole, and the sample be wholly spoiled.

But besides the danger to which grain is exposed when laid up, from the want of dryness and ventilation, it is liable to be destroyed by the depredations of animals of different kinds, in the states before they assume that of the insect\*. As these are produced from ova deposited among the grain by the animals when in their more perfect or insect growth, it is obvious that the best means of guarding against their ravages is that of preventing their generation by the destruction of the ova before they assume the vermicular state. This is best effected by frequent screening and exposure to a current of fresh air: as by these means the nests which contain and protect them are broken and destroyed, and the animals after passing through the screen in the different operations are wholly removed with the other extraneous matters.

The exposure of grain to the free action of the atmospheric air has been condemned by some from the circumstance of the ova of

\* The Moth, Weevil, and Beetle.







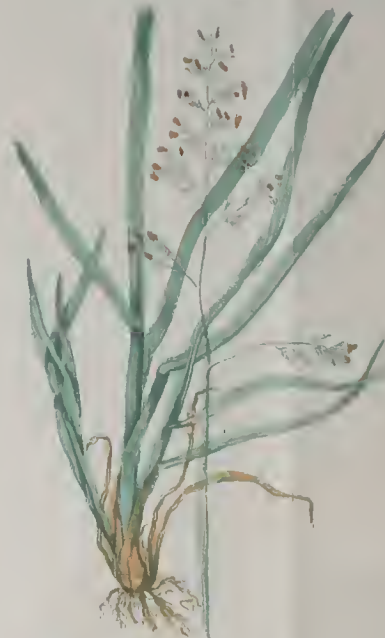
Long Tail Grass  
*Lyneis setacea*



Hard Fescue Grass  
*Festuca duriuscula*



Rough Cock's Foot Grass  
*Dactylis glomerata*



Common Cock's Foot  
*Dactylis glomerata*



GRASSES.



Birdfoot Trefoil  
*Lotus corniculatus*



Dutch White Clover  
*Trifolium repens*



The Red Clover  
*Trifolium pratense*

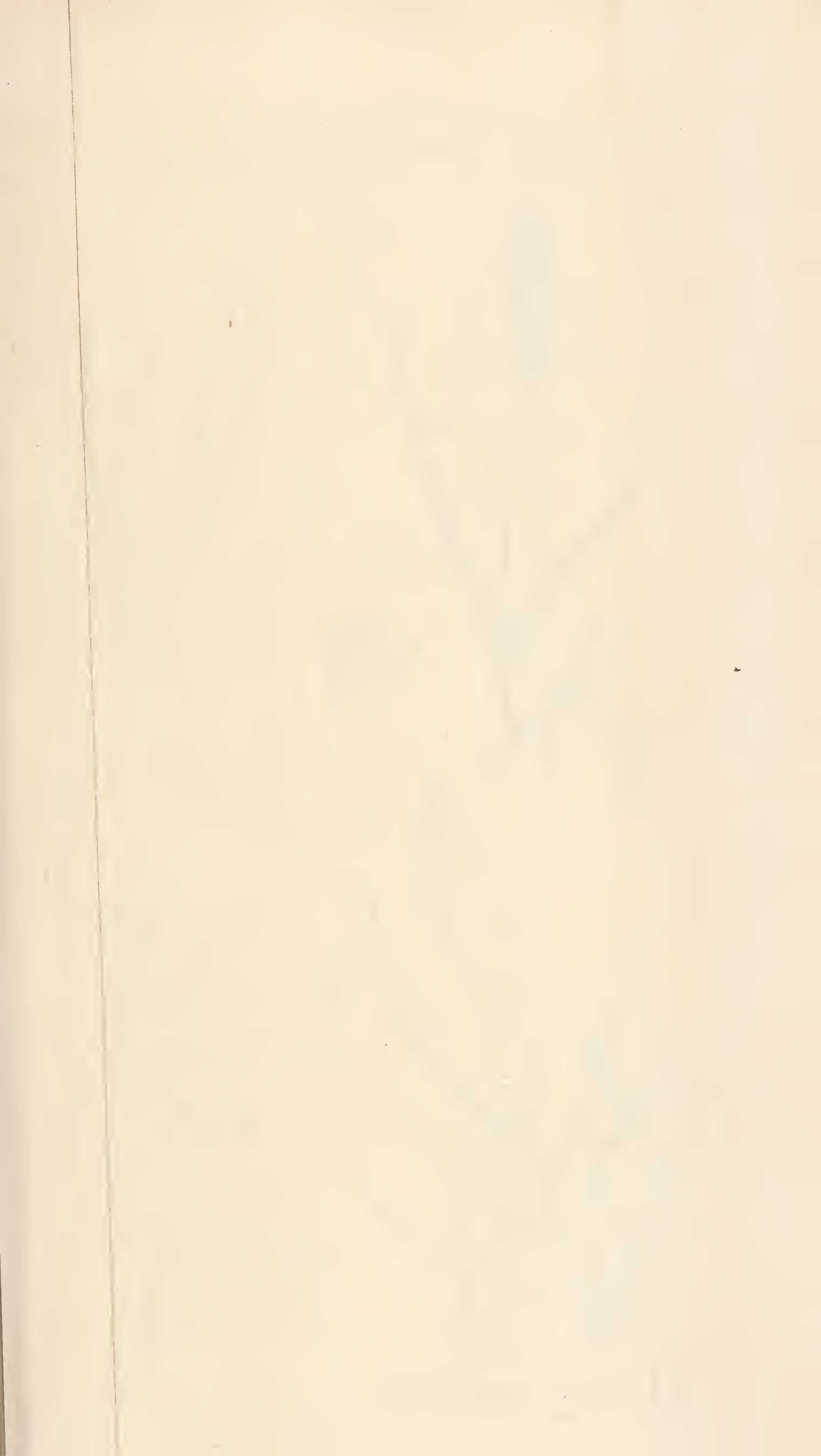


Sainfoin  
*Onobrychis asclepiadifolia*



The Lucerne  
*Medicago sativa*



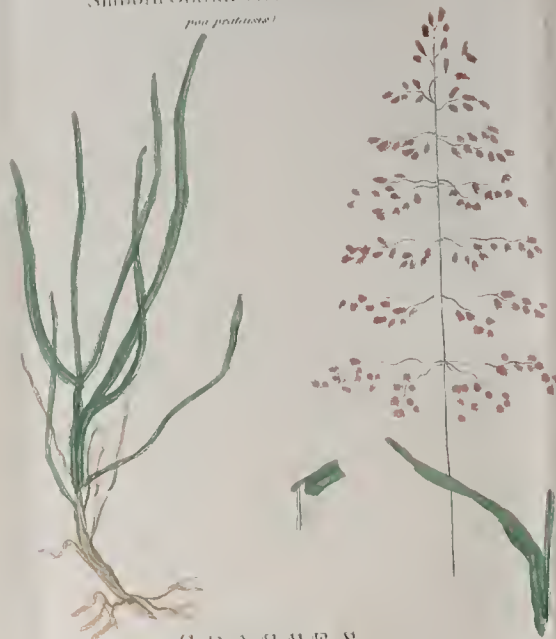




Meadow Foxtail Grass  
*Setaria pectinacea*



Smooth Stalked Meadow Grass  
*Poa pratensis*



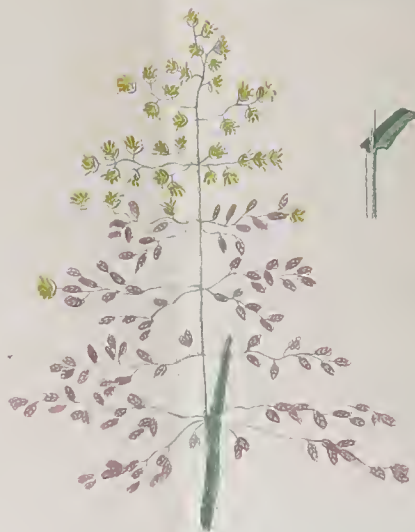
Sheeps Fescue Grass  
*Festuca ovina*



GRASSES



Sweet Scented Vernal Grass  
*Anthoxanthum odoratum*



Rough Stalked Meadow Grass  
*Poa trivialis*



Meadow Fescue Grass  
*Festuca pratensis*





Insects being liable in that way to be deposited among the corn; but it is more probable, when the economy of such insects is considered, that their ova are either deposited originally among the grain in such situations, or brought in with different parcels of corn from other places. On this last account great caution should be used in bringing fresh parcels of grain to be laid up, and the use of the screen be constantly had recourse to before it is attempted.

Where corn is to be preserved for a considerable length of time, though it may unquestionably be kept with safety by proper care and attention in granaries or corn-chambers, it is probably a much better, as well as more certain and economical practice to suffer it to remain unthreshed from the ear, in the stack, especially when built on proper staddles in the manner that has been described above.

In cases where the corn is ground, and afterwards preserved in the state of meal, it is the best practice to pack it as closely as possible, by treading it into perfectly dry small close rooms, as when laid up in proper condition in this way it will keep perfectly safe for several years.

When it is necessary to preserve grain for any length of time after it has been threshed out, it is obvious that proper granaries should be provided; the size of which should constantly have a relation to the extent of the farm, being always sufficient to contain one half of the corn that is produced when it is threshed out. In their erection the proprietor should probably, in all cases, except where there are very long leases, be at the whole of the expense.

But though the practice of preserving grain in stacks or granaries, from the convenience and advantages that may in some cases arise from it, both to the farmer and the public, may be in some degree necessary, it is evident from the result of experiments carefully made, that the storing of corn in either way should be carried to as little extent as possible, as there is found to be a constant decrease in its weight, from the period at which it has been harvested or laid up, but that at first this loss is considerably greater than when the corn has been kept for some time. On these grounds it is therefore sufficiently obvious, that the sooner the produce is brought to the market, the greater must be the advantage to the proprietor, provided other circumstances be the same.

## SECTION XVII.

### *Cultivation of Arable Land.—Laying down to Grass.*

HAVING explained in the former section the culture which is necessary in tillage lands, and the various modes of cutting, managing, and preserving the different sorts of produce, we shall proceed to the means of restoring them to the grass, or the state of sward.



*Lands proper for Tillage and Grass.*—It is obvious from what has been already advanced that some sorts of land are much better calculated for the production of grain crops than those of the grass kind; while, on the contrary, there are others that are much more suitable and better adapted to the raising of grass than corn crops. There are still others that may be cultivated under a convertible system of corn and grass, with more success than in either of the other methods alone.

Of the first description are all those lands which possess a sufficient degree of dryness, whether they have much staple or depth of mould or not, and which in their natural state have but little tendency to produce good herbage, such as those covered with different sorts of coarse plants and vegetable productions, whether in an open or enclosed state. It has been well observed by a late writer, that grounds of this nature are of considerably more value when in a state of tillage than in pasture; as they are particularly adapted to the improved modes of husbandry, and in addition to the quantity of grain to be produced from them, will afford a greater quantity of vegetable food for animal stock when in a tillage state, than they did when kept entirely in pasture.

There are various descriptions of light lands that may likewise be kept in a state of tillage with more advantage than in that of grass, as they are peculiarly suited to those improved modes of cultivation that are necessary for raising large supplies of green food for the support of live stock of different kinds. The poorer sorts of sand lands, where marle, clay, chalk, or other similar substances can be readily procured, are much more proper for the purposes of tillage than those of grass, as is sufficiently shown by the improvements that have been made in many of the more southern districts of the kingdom. Lands of the chalky kinds, whether of the more superficial or deep descriptions, are in most cases better suited for tillage than grass, as from their wetness in the winter season, and their openness and friability in the summer, it is almost impossible to establish good herbage.

And there is still another sort of land that is better for the purposes of tillage than those of grass, which is that which in the state of grass is constantly so disposed to the production of moss, as to afford but a very scanty share of good herbage.

Most of the clayey and more heavy descriptions of land, especially when situated in valleys, or other low confined exposures, though they may be capable of affording good crops of particular kinds when under the plough, as those of the wheat and bean kind, are, on account of their retention of moisture, the increased expenses of labour, and the uncertainty of season for tilling them, as well as their inaptitude for most other sorts of crops, and their fitness for the production of good herbage, much more beneficial in the state of grass than in that of tillage. Where there is an opportunity of procuring sea sand, and of applying it at an easy expense, they may however be converted to the purposes of tillage in a profitable manner. Most of those strong cold grass lands which in a state of tillage would be improper for the growth of turnips, and other applications of improved cultivation, should also constantly remain.



in the state of grass. And likewise those lands that are situated near large towns, where manure is plentiful, and of course capable of being procured at a reasonable rate; and where the produce of such lands is always in great demand, and therefore capable of being disposed of to great advantage. Such lands as are situated on the banks of large rivers or brooks, which are capable of being improved by means of watering, are likewise more beneficial when kept constantly under the grass system than any other mode of cultivation that can be practised. The lands of a calcareous nature which are distributed in the valleys of the more mountainous districts, where old grass land is scarce and of much importance, and most part of that in the state of tillage incapable of being converted to the condition of good grass, may also be the most advantageous when continued in a permanent state of herbage. The sorts of land that are the most adapted to the practice of convertible husbandry are those of the loamy kinds, which are not too strong for the growth of turnips. These in all their different varieties are capable of being changed from the state of tillage to that of grass, and the contrary, not only without sustaining any injury, but frequently with the most evident advantage, as the practice of some of the western and midland districts has fully proved.

The richer kinds of sandy lands are in most cases also well suited to this sort of husbandry; especially where marle is at hand, to be applied at the time of laying them down to the state of grass.

And grounds of the peaty sort may in many cases be the most beneficially employed in this mode of culture, as, from their producing little else than plants of the aquatic kind, it is obvious that they must be completely destroyed, and those of the proper grass kind be introduced, before any useful herbage can be produced. And this is capable of being accomplished in by much the most perfect manner under the state of tillage. But as they are in most instances much too tender and moist for the purpose of remaining long in the state of tillage, as soon as the above intention has been fully effected, they should be restored to the state of permanent grass.

*Converting Lands to Grass.*—It is evident therefore that some sorts of soil are much more difficult to be brought into the state of grass than others, and that, when this object has been attained, some are much more profitable and advantageous than others, as affording a much better and more permanent herbage. In some districts the business of restoring the land to the state of sward, after it has been in that of tillage, is effected with the greatest ease and facility: the ground, on being left in an unploughed condition, from its natural tendency to the production of herbage, returns to the state of sward, almost without trouble, seed, or expense; while in others all the art of the most careful agricultor is found insufficient for accomplishing the purpose. It has been remarked that “after twenty years fruitless expectation and expense, the landholders have frequently been obliged to restore the land again to a state of tillage.”

But besides this disposition in soils for taking on the growth and



establishment of grass crops, there are other circumstances to be considered in restoring them to the state of sward after they have been under the plough; such as those of their possessing either too much or too little moisture, and that of their having a sufficient staple or depth of mould for the full and secure establishment of the grass plants. As where the soils are too wet, or too retentive of moisture, they will sustain much injury if not be wholly destroyed during the winter season, when there is much rain and frost, as well as be quickly superseded by plants of the coarse aquatic kind, such as the rush, &c. And where they are too dry, the grasses will be liable to be destroyed by heat during the summer months, by the little moisture which they contain being thus carried away, and of course leave their places to be supplied by other sorts of coarse plants, such as those of the moss, fern, and heath kinds, according to the nature of the ground. A good depth of mould or soil is likewise requisite, in order that the roots of the grass plants may penetrate or run down to such a depth below the surface, as to be in a great measure out of danger from the effects of heat and evaporation in the summer season. On this as well as other accounts it is therefore better that the lands intended for grass, especially where they are to be kept in a permanent state of sward, should incline in some measure to a state of moisture, or be in such a degree retentive of it, as to preserve that state of humidity which is necessary for the healthy and vigorous growth of the plants, without endangering the destruction of their roots by putrefaction, from its stagnating in too large a proportion about them. It is chiefly on this principle that the more light, thin, dry descriptions of soil are better suited for the production of grain, or the occasional practice of convertible husbandry, than for that of permanent grass.

There are still other circumstances connected with the nature of the soils, which are necessary to be particularly attended to in the laying of lands down to the state of grass, as those of properly adapting the grass plants to their qualities, some sorts of grasses being much more impatient of wet than others, consequently more proper for the drier sorts of land; some more capable of resisting the effects of heat and drought, and of course more suitable for the thinner and more porous kinds of soil; while others delight in a moist or wet soil, and are incapable of being grown with any success on such as are of a dry quality. They likewise differ much in respect to their hardiness, some resisting the effects of cold much more effectually than others, of course are more adapted to high exposed situations. Besides these, they vary in other respects, some succeeding to the most advantage in soils of the clayey kind, others in those of a loamy quality, while others delight in those of a sandy nature, a few in those of the calcareous kinds, and some in those which partake much of the nature of peat.

And in addition to these different natural propensities, there are some grasses that have the property of rising to a great height in the stem, and of course of affording a large coarse produce, while others are more limited in this respect, but spread and extend themselves more in a lateral direction, affording a less proportion of



produce, but which is of a finer quality. The former, with certain restrictions, would seem better adapted to the purpose of hay, though the latter may be applied to the same use, where the fineness of quality is preferred to quantity of produce. There are likewise some sorts of grasses that contain much larger proportions of saccharine matter in their compositions than others, as well as more leaves and fewer flower-stems; and which, from the avidity with which they are fed upon by different sorts of live stock, and the success that attends their being thus consumed in the improvement of such stock, would appear to possess the largest proportion of nourishment; and of course to be the most proper for being introduced where the lands are intended for the purpose of grazing, or fattening animals by means of vegetable food in its grassy state.

There is another property of grasses in which they differ considerably; and which it is of much consequence to have regard to in the laying lands to the state of sward. This is that of early growth, which is a circumstance of vast importance in a grazing point of view, as there is in general a great deficiency of grass for the support of stock in the early part of the spring.

It is indeed the opinion of a late intelligent writer, that in the forming of good meadows, or other grass-lands, there should be a combination of these different circumstances, as it is chiefly by the first, or the quantity of produce, that the cultivator is enabled to support his live stock, and pay his rent; of course no expense in labour or manure is spared to obtain it by the prudent farmer. It does not however follow, he says, that this should be solely regarded, or that to attain it the coarsest sort of plants should be cultivated; nor will the grasses that are recommended merely for their being relished by cattle, or for the sweetness of their foliage, if they are found to be deficient in the quantity of produce, fully answer the views of the farmer or grazier, as, to constitute a good meadow or pasture, an abundant produce is necessary. Though animals prefer some sorts of food to others, it is not possible to indulge the live stock that is to be supported constantly with the finest and most delicate hay, or herbage. Besides, it is not improbable but that the productive grasses may in some cases be highly nutritious, or that cattle may eat as eagerly the herbage, or hay, made from the coarse as the fine grasses. And cattle are frequently known to thrive on food to which they are habituated by necessity, though at first they could scarcely be prevailed on to eat it.

In making experiments, persons are apt, he conceives, to conclude too hastily from the appearance which a plant assumes on its being first planted or sown; as the most insignificant vegetable will often make a great show, when its fibres have fresh earth to shoot into: but the trial comes when the object of the experiment has been in a meadow or pasture several years, when its fibres, from long growth, are matted together, and it meets with powerful neighbours, to dispute every inch of ground with it: if it then continues to be productive, it must have merit. It is well known, he says, that lucern, when left to itself, is soon overpowered; and if broad-leaved clover, which is undoubtedly a perennial, the first year be-



sown, a great crop is produced; but let the field be left to itself, and the clover, like the lucern, will yearly diminish,—not because it is a biennial, as has been often supposed, but because plants hardier, or more congenial to the soil, usurp its place: this shows therefore that at the same time that a good plant is introduced, it should be a powerful one, and such as is able to keep possession, and continue to be productive.

In respect to the property of cattle's thriving on the food they eat, it is unquestionably of great consequence; and it is to be regretted that our knowledge of the most nutrient kinds of herbage is so confined; but of those plants which have been in cultivation we are enabled to speak with some certainty: it is well known that clover, lucern, sainfoin, tares, and several other plants, have a great tendency to fatten cattle; but what natural grasses, or other plants, which have not been subjected to separate culture, have this particular tendency, and in what degree, remains to be ascertained by the test of experiment. But as leguminous plants are in general found to agree with cattle, it may be reasonably concluded, he thinks, that a certain quantity of them may be proper and advantageous in pastures.

It is well known that certain pastures are more disposed to fatten animals than others; but how far this depends on situation, and their particular produce, remains to be ascertained.

With respect to the property of early growth, the want of early herbage in the spring is the general complaint of farmers and graziers in all the best grass districts of the kingdom: those plants, therefore, which are found to shoot at an early period, and to put forth early foliage, especially when it is such as is grateful to cattle, must be deserving of great attention. As far as grasses have to do in this business, the few mentioned hereafter may, he supposes, effect all that can be expected in this way: much must, however, depend on seasons: if the winter should be severe, or north-easterly winds prevail in the spring months, grassy herbage will be backward, in spite of all that can be done; but in order to counteract the bad effects of such seasons as much as possible, pastures and grass-lands should, in his opinion, be warmly situated, and not drenched too much with moisture, being sheltered by thick hedges, and divided into small enclosures. But where early pasturage is the great object of the cultivator, there are other plants that may deserve a place among them, such as those mentioned below.

And though early herbage is highly valuable for pasturage, it is not less so for the purposes of hay; as by the middle of May at the latest, a meadow of this sort would be fit for cutting; and the second hay-making might begin by the time that hay-making usually takes place in other cases; and by this means the double advantage be obtained, of a larger produce, and less risk in securing it.

On the principles that have been already explained, there can be little doubt but that by a judicious and due attention to the different circumstances and uses for which grass-lands are intended, as well as to the selecting and mixing of the best and most proper grass-seeds, and adapting them to the particular nature and circumstances



of the soils, after they have been brought into a suitable condition for receiving them, those grounds which have been in a state of tillage may be laid down to the state of sward, in a much better and more beneficial manner than has been the case under the indiscriminate use of such as were in, or which have sown themselves on the lands from the contiguous pastures.

It has indeed been long since remarked as extraordinary, that cultivators should have neglected to make a proper advantage of plants of such importance, and which, in most situations, constitute the principal food of live stock, from the want of properly distinguishing and selecting such as are the most advantageous and useful under different circumstances of the land. Some have likewise contended that the best grass-seeds cannot be collected at too high a rate, as it is possible by such means to render lands, which are suited for the production of grass, much more valuable than can be done by the common modes of laying them down.

Much difficulty has without doubt been thrown in the way of introducing the most proper sorts of grasses, in laying lands down to sward, from their near resemblances to each other, in many instances, requiring the nicest discernment to distinguish them, and from the want of other means of procuring them.

It has been lately observed, that if grass-lands, such as downs, pastures, and meadows, be carefully examined, they will all, except such as have been recently laid down with rye grass or clover, be found much in a state of nature, replete with an indiscriminate mixture of plants, some of which produce cattle-food of a good kind: others, such as is of a very indifferent description; some affording good crops, while others scarcely yield any at all. It is therefore sufficiently obvious, that by a careful attention to the procuring of the best and most suitable sorts of grass-seeds, and applying them according to the principles which have been given above, much superiority may be attained in the forming of pasture or other sorts of grass-lands.

*Preparation of Land for Grass Seeds.*—This is a part of management that is of vast importance to the success of forming good grass lands, but which has been much neglected in the practice of laying them down. From the smallness of the seeds, and the fibrous nature of the roots of the grass-plants in most cases, it is evident that lands which are intended for being laid down to the state of sward, whatever their quality may be in respect to soil, should constantly be brought into as fine a state of pulverization and mellowness as possible before the seeds are put in. As where the contrary is the case, from the lumpiness of the surface mould, the seeds can neither be sown with so much regularity, vegetate in so equal a manner, or extend their roots, and establish themselves at first so perfectly in the land, they are of course more liable to be destroyed by hot seasons coming on afterwards. It is probable that in this way much new laid down grass-land is greatly injured the first summer, especially when it turns out to be hot and dry. The necessary fineness of mould may be obtained in different modes, according to the nature of the lands. In the more stiff and heavy ones,



by ploughing before winter, and leaving them to be exposed to the action of frosts and other causes during that season; having recourse to severe harrowing and occasional rolling in the early spring months; and by the frequent interposition of such sorts of crops, in the courses that precede those of grass, as have a tendency, from the peculiar nature of their roots, to loosen and render the soils fine, such as those of the bean, cabbage, rape, and clover kinds. The lighter sorts of land may be brought into a proper condition for the reception of grass-seeds, by repeated ploughing and harrowing, or scuffling, and the frequent introduction in the previous crops of such sorts of green fallow crops, as have a power, by the great degree of shade and stagnation which they afford, as well as by the culture which they require while growing, of bringing the soil into a fine friable state. These are turnips, potatoes, tares, sainfoin, and others of a similar description. It has been observed by an intelligent cultivator, that where the grass-seeds are to be put into the ground with grain crops in the spring, the tillage should be performed with more than ordinary attention; which, in the case of turnips, will depend greatly upon their being consumed at such an early period as will admit of the ground being thoroughly broken down and reduced: for if there be much delay, and the season prove unfavourable, a bed of mould, sufficiently loose and mellow, will not be procured for the reception of the seeds: and when grown with spring corn, the lands should be ploughed over three times: and where the first of these earths can be given early enough to be influenced by the vernal frosts, it will be found to be much more beneficial. The use of the harrow and the roller will be occasionally necessary after the different ploughings, according to the nature and state of the land. But where the sowing is executed in August the same degree of attention is not believed by some to be so necessary, as the time and season afford so full an opportunity of bringing the ground into suitable order, that the most inattentive cultivator can scarcely experience any other difficulty than what originates from an unusual wetness of season.

But besides this fineness of preparation in the soils, it is necessary that the method of cropping and application of manure in the preceding courses be such as to leave them in a state of high fertility and richness; as no good grass-land can be supposed to be produced where the lands have been worn out and exhausted by the previous crops,—a practice which has, however, been too general in the returning of arable lands to the condition of grass. Mr. Marshall has indeed very justly observed, that the want of proper condition in the lands at the time of their being laid down to sward; added to those of improper sorts of grasses and bad seeds, is the chief cause of their not succeeding. According to some, manure ought to be applied with every other crop, and always with that which immediately precedes the grass. This is a practice that should be adopted as much as possible.

In order to have grass-lands of the best kind, it is likewise of great utility to have them so managed in the preparation, as to be rendered perfectly clear and free from all sorts of weeds, as by their



rising with greater rapidity than the sown grass-plants, they are often liable to shade and destroy them, or greatly injure their growth.

It has been advised by an experienced cultivator, in restoring old worn-out lands to the state of good pasture, to clear the land from injurious weeds by means of a full winter and summer fallowing, or, instead of the latter, by a crop of potatoes well manured for, and kept in a perfectly clean state by attentive culture while growing, succeeded by winter vetches fed off in the early spring. In all the more light sorts of soil, it is unquestionably the most beneficial practice to bring the ground into that sort of fine tilth, which is proper for the reception of grass-seeds, by a judicious mixture of green crops of different sorts with those of the corn kind, according to the nature of the soil. The most appropriate methods of inter-mixing these with each other have been already explained in speaking of arable-cultivation.

When the lands have been by these methods brought into a good state of fertility, and reduced into a sufficiently mellow and friable condition of mould, the surface should be made as fine, loose, and even as possible. Where the grounds are much inclined to moisture, the ridges may be preserved, which should be of considerable breadths with very slight furrows; but in the more light and porous descriptions of land, the whole should be laid as even as possible without any ridges or furrows. In the former cases, in some districts they prefer making the ridges six, eight, or more yards in breadth, which when the land is to be under the scythe is in a much better state for being mown, and if for pasture there will be less danger of the animals being injured by being cast in the furrows. And in the latter the surface will not only be more agreeable in its appearance, but be more advantageous for all the purposes of grass management afterwards.

*Proper Kinds of Natural Grasses.*—The circumstances that have been already observed, render it sufficiently evident that the proper choice and application of grasses must be a matter of great consequence in the laying down lands to the state of sward. But it is obviously a business attended with uncommon difficulty, from the number of trials that have been yet made, being very inadequate for affording the means of fully deciding upon their properties, advantages, and uses, in many cases, as well as from their habits, and the soils to which they are the best suited, being often very imperfectly known: and also from the great trouble and inconvenience of obtaining their seeds genuine, and in a proper state for the purposes of healthy vegetation.

The grass plants of the natural kind which have been found by experienced cultivators most useful and beneficial in the different views that have been before suggested are: the Sweet-scented Vernal Grass; Meadow Fox-tail Grass; Smooth-stalked Meadow Grass; Rough-stalked Meadow Grass; Meadow Fescue Grass; Sheep Fescue Grass; Hard Fescue Grass; Tall Fescue Grass; Crested Dog's tail Grass; Ray or Rye Grass; Yorkshire White; Cock's-foot Grass; Tall Oat Grass; Timothy Grass; Yarrow; Burnet;



White Clover; Trefoil; Cow Grass; Rib Grass; and a few others which will be described below.

Most of these different sorts of grasses will be found useful in laying lands under different circumstances of soil, situation, and moisture, or dryness, to the state of sward.

*Sweet-scented Vernal Grass* \*.—This is a sort of grass that comes early into blossom: it is of course valuable as an early grass, and it is also valuable for its readiness to grow in most kinds of soil and situation, being found in bogs, in woods of low growth, or which have had the underwood removed, in rich meadows, and in dry pastures; but in point of crop it is not so productive as some, yet more so than others: cattle are said to be fond of it, and it is well known to be the only grass of this climate which is odoriferous; the agreeable scent of new-made hay being produced almost entirely by it; and the green leaves, when bruised, readily impart this odour to the fingers, by which means the foliage may constantly be known; and it may be readily distinguished when in blossom by its having only two threads or stamina to each flower. But it is less productive in point of seed than many of the other grasses. In certain situations, especially in dry seasons, its leaves are apt to be blighted, from a disease which changes them to an orange hue, and which has proved highly injurious to the plants when in a cultivated state.

From constantly flowering in hard stocked pasture lands, some suppose that it is not much relished by cattle in common. In a slight proportion, as that of one eighth, it may however answer well. It thrives well on poor sandy soils.

*Meadow Fox-tail Grass* †.—Is a sort of grass that sends forth its spike almost as soon, and in some situations full as early, as the Sweet-scented Vernal; it is consequently equally valuable as an early grass; and as it is much larger and quicker in its growth, it is of course much more productive: it shoots very rapidly after mowing, producing a very plentiful aftermath: and where the land is rich, and two crops are not thought too much for it to bear, of all the grasses of this climate it appears to be the most adapted for such a purpose, and ought to form a principal part of the crop in such cases. Its foliage may seem coarse to some; but it must be kept in mind that no grass can be productive that is not in some degree coarse. If it be mown early, just as it comes into bloom, though the leaves are large, the hay will not, however, be coarse. In general, the great advantage proceeding from the earliness of these two grasses is entirely lost in those districts where hay-making begins at a late period, and where a crop of indiscriminate herbage is waited for by the cultivator.

It is in some measure distinguished by the largeness of its foliage, and by its producing a soft spike on a long stalk about the beginning of May. This is a great objection to it, as the seed cannot be always obtained in plenty. On a situation where it was perfectly established with thick herbage it was found to produce but few seed-stems.

\* *Antoxanthum odoratum*.

† *Alopecurus pratensis*.



In respect to the places of its growth, it is more confined than the first sort, growing naturally in a moist soil only : on this account some think it best adapted for improving such wet grounds as may be drained of their superfluous moisture, or for forming or meliorating meadows that have a moist bottom, and are not apt to be burnt up in dry summer seasons. Others, however, suppose that there is scarcely a better grass for moist loams and clays, as it is extremely early, and abides nine or ten years on soils upon which the Meadow Fescue gives way to those of other kinds. It has likewise by some been found hardier against frost and excessive cold. Others speak of it as excellent, both for pasture and hay, as being highly productive, and the first as a dairy grass. The seeds are easily collected, according to the accounts of some accurate observers ; but a great number of them, in certain seasons, are liable to be destroyed by a very minute orange coloured *larva*, or maggot, which feeds on the embryo of the seed, and most probably produces some small species of fly.

*Great or Smooth-stalked Meadow Grass* \*.—In this grass the foliage also begins to shoot and to assume a beautiful verdure at an early period in the spring ; but the flowering stems are not produced so soon, by a week at least, as those of the last : this slight difference, in point of earliness of flowering, does not, however, prevent it from being properly ranked with the two preceding grasses. Where early grassy pasturage is the great object of the cultivator, it cannot probably be better obtained than by a judicious combination of these three grasses. If quantity of crop be at the same time in view, the Meadow Fox-tail Grass should predominate in a considerable degree.

It in some measure affects a rather dry than a moist situation, on which account it keeps its verdure in long-continued dry seasons better than most other sorts ; but it is capable of thriving in either pretty well, though more luxuriantly in rich meadows. It is liable to some objection from its creeping root, which when established is difficult to extirpate : it should of course be cautiously introduced where the land is not intended to remain in a permanent state of sward.

By some it is considered, however, as a highly valuable grass, as all animals are fond of it ; and it affords the best hay, as well as the richest pasturage. In addition to its other qualities, it has the property of abiding continually in the same ground, while most other sorts are liable to change. On rich loams it has been found, by some, a highly valuable grass, succeeding well with different cultivators.

According to Mr. Curtis, this grass is now readily distinguished from the Common or Rough-stalked Meadow Grass, as it has a smooth stalk, while the other has a rough one, which is perceptible when drawn betwixt the thumb and finger, and which proceeds from little sharp points, visible when the sheaf of the leaf, which covers the stalk, is magnified ; besides, the latter has a long pointed membrane at the base of the leaf, while in the former it has a short blunt one. And further, it only throws up flowering stems or bent ones in a season ; from which peculiarity, combined with its hardiness and

\* *Poa pratensis*.



verdure, it appears well-suited for the lawns or grass-plats of pleasure grounds.

Notwithstanding what has been just observed in regard to its property of remaining in the land, in dry soils the crop from this grass has sometimes been found to diminish in quantity annually, and to become ultimately very small, especially when the roots have become matted, and exhausted the ground, which they seem much disposed to do; but in moist meadows this effect has not been so much noticed.

It has been remarked by Mr. Salisbury, that this grass is likely to be a scarce kind in cultivation, as the seed is not to be collected in any quantity, neither does it produce it abundantly when grown on purpose.

*Common or Rough-stalked Meadow Grass* \*.—Though this grass has much similarity to the preceding in appearance, especially in the mode of flowering, it differs essentially in its qualities, as the former is chiefly found in dry pastures, while the latter principally occurs in moist meadows. It delights in moisture, and situations that are sheltered; on which account, though there are few more productive or better adapted for the purpose of hay or pasturage, it is tender, and liable to be injured by severe cold or drought: and in moist rich ground it has been observed to grow tall, while in poor land it has been found equally diminutive.

It is said by some cultivators to be a grass well adapted to good, sound, moist loams. On the continent it is greatly esteemed both for dry pastures and water meadows, as it multiplies much by seed as well as root. It is therefore necessary to permit the seeds to fall, in order to preserve the quantity undiminished. The produce is admirable for the feeding of all sorts of cattle. It is, however, considered by some as inferior to the last sort, from its property of going off after being cut, being supplanted by those of the bent kind: but its radical as well as stem-leaves grow larger.

According to Mr. Salisbury, this grass in certain situations is to be ranked among the best and most productive grasses; but on examining the plant in many other places where it grows spontaneously, he finds it so very small and poor, that unless circumstances were much in its favour, agricultors should, he thinks, be careful how they hazard the sowing it; the places where it is observed to thrive best, are, he says, in low wet soils consisting of a heavy loam and clay: farmers who have lands of this description would certainly do well to select this kind for the purpose, as it is sweet, and seems to possess all that is necessary for either pasturage or hay.

As the seeds of this as well as those of the last sort are apt to be entangled, and adhere to each other, it is difficult to disperse them evenly in sowing. This circumstance should therefore be attended to in putting them into the land.

*Meadow Fescue Grass* †.—This is a grass that comes near in its appearance to Ray Grass, but to which it seems greatly superior, at

\* *Poa trivialis.*

† *Festuca pratensis.*



least for the purpose of forming or improving meadows; as being larger, and more productive of foliage. It is strictly perennial and hardy, thriving well not only in wet but in dry grounds; growing in all situations, from the sand-pits at Charlton to the osier-grounds at Battersea; and it abounds in the best meadows, in the best hay districts: in short, it seems well calculated to supply the defects of Ray Grass. Besides, it has the quality of producing more seeds than most of the other sorts of grasses, which are easily gathered, and grow readily. It is however inferior to the three first of the above grasses in one property, which is, that it does not produce its flowering-stems sooner than about the middle of June, which is a fortnight or three weeks later than the second of them; though it cannot be considered as a late grass, as those of the bent and some other sorts flower later by three weeks or more.

The able botanist mentioned above observes, that no plant whatever deserves more the attention of the farmer than this, it being of certain growth, easy culture, productive, and remarkably sweet. It will thrive in either dry or wet soils, an advantage which most others do not possess; it appears to be little inferior to fox-tail, except in point of the early growth.

One reason why this as well as many other grasses were not formerly more generally introduced into cultivation, was the difficulty of distinguishing the grasses from each other: but which, from the study of agricultural botany, is now in some measure done away: but a greater till lately has always presented itself, which was the difficulty of procuring pure seeds of the different sorts.

*Sheeps' Fescue* \*.—This grass has been much praised by some, both for the purposes of pasture and hay; sheep and other sorts of live stock being very fond of it, and soon rendered fat in pastures where it prevails. But from its affording in dry heathy exposed situations, and commons, but a very small produce, and its foliage being hard and wiry, as well as from its appearance in dry summers being unpleasantly brown; and in rich moist ones, where the foliage retains its verdure, and becomes much taller; from its being in its nature a small plant, it cannot be productive, consequently cannot be considered as in any way fit for a hay grass. It is said by some to be capable of thriving on any soil, but best on those of this light spongy kinds, as it can live with less moisture than most other grasses. And it is asserted to be one of the excellencies of this grass, that it will establish itself upon such soils as scarcely any other plant can be made to succeed on; being of course of much utility in covering barren spots, that might otherwise have remained uncovered for a great length of time.

Others however observe, that if it were sown on rich moist soils, the grasses and other plants, which are natural to such lands and situations, would soon overpower it, and in a very short time there would scarcely be a blade remaining to be seen on the ground. And were it for the purpose of sheep feed to be sown on the high down and heath lands, the animals would starve upon them in dry sum-

\* *Festuca ovina*.



mer seasons. Where a close matted turf, without a great produce, is required, it may, however, be found useful.

*Hard Fescue* \*.—This is an early and productive grass with fine foliage, which grows well on downs and rich meadows. It is well adapted for being combined with other grasses in forming sheep pastures; and by some it is said to constitute the best hay. Mr. Salisbury has not found the same fault in the culture of this grass as is mentioned by Mr. Curtis, which is, that it is apt to become thin and almost disappear after a while; on the contrary, he finds it stands the driest soil equal to any, gets matted together and forms a most delightful turf in very dry weather.

*Crested Dog's-tail Grass* †.—This is a grass that has been much recommended as a favourite and wholesome food for sheep. It is found in the soundest and best pastures, but grows best in dry situations, and will not thrive in meadows that are very moist. It flowers nearly at the same time as the meadow fescue grass, but is not very productive of foliage. The appearance of its bents in poor, high, moist pastures, suggests the idea of its being an indifferent plant. But its abounding in most of the richest grazing pastures in different parts of the kingdom, and its being in some the principal herbage, leads us to conclude that it is an useful grass. As its flowering stems and heads are seldom consumed by cattle, its seeds may be collected, where the pastures are fed, with great facility; and as they are abundant, may be gathered by children at about one shilling the pound.

Land may be laid down with it in a successful manner, if proper attention be bestowed in having the seed collected when fully ripe, as it has been known to fail on this account. On the continent it is in high estimation as a pasture grass. From the fibrous nature of its roots, not admitting the running down much into the soil, there may be danger of its being destroyed in dry summer seasons.

As it abounds greatly in the best pastures, and is a blade grass that shoots up the first after the land has been mown, its thickest tufts are said to afford much food for sheep in the time of snow and severe weather in the winter season. Those who are not accustomed to distinguish the difference of grasses with much accuracy, may, it is observed, despise it, as of an improper and useless kind; but the sheep and the ox, who must be allowed better judges, will soon convince them of its importance. From the rapidity of its growth it may be apt to get coarse, if not cut down more quickly than is often the case. The seed is small and fine, but may be obtained with much facility by passing the stem in a tight manner through the hand. It has been procured at sixpence the quart.

*Ray or Rye Grass* ‡.—This is a sort of grass that has been much in cultivation, but is deficient in some of the properties necessary for meadow or pasture lands. The objection on the score of its producing little more than flower-stems or bents, is said to be only found valid when it grows in upland pastures and dry situations: in rich moist meadow its foliage is more abundant; and it seems



probable that it is highly acceptable and nutritious in feeding cattle: its foliage is of rapid growth, the flowering stems continually shooting forth. It is, however, a grass that varies greatly, according to situation and circumstances.

It is best adapted to the loamy and sandy descriptions of soils; but it will succeed on any except stiff clay, and even on that it may be grown. On the richer sorts of the two first kinds of land, it frequently turns out both a good vernal and permanent pasture grass when employed in due mixture with other sorts; and it is particularly suited to be fed by sheep. It is not, however, so early as some of the grasses that have been described above. This grass, Mr. Salisbury says, seems to chiefly affect a loamy soil, is not very productive, but, being a strong perennial, has been much recommended: it flowers about the time of the hard fescue, and is considered good for sheep food; and the butter made from pastures where it grows is generally esteemed excellent.

Some of the varieties of this grass, as those cultivated by Mr. Peacey, are said to be much superior to the common kind, by those who have had great experience of them.

*Meadow soft Grass, or Yorkshire White*\*.—It is common in meadows and pastures, and is hard and productive of foliage, but flowers much later than the first of the above grasses: its foliage is soft and woolly. It thrives best on soils of the more moist kinds; but may be grown on almost any that are not very dry and in poor condition; and even on these it is sometimes met with. By some cultivators it is chiefly advised to be made use of with a view to sheep pasture, as it has not been found equally good for other sorts of stock. And it has been found to answer best when kept very closely fed. It has been supposed useful for neat cattle, but very indifferent for horses.

It grows in a quick manner, and affords good-sheep feed in the winter season; and would seem from the following fact, to be much relished by live stock: on two fields being laid down adjoining each other, one with this grass, and the other with rye-grass (*Lolium perenne*), the former was eaten much closer than the latter, by the stock turned upon them.

*Rough Cock's-foot Grass*†.—This is a coarse, rough grass, but very hardy and productive. It is common in meadows; and rather early. Some condemn it as not only an indifferent grass, but one that is often rejected by cattle. Others, however, on the authority of experience, consider it as highly valuable on moist loams where the bottom is of a clayey marle nature; and in cases where the grasses of a finer kind are liable to be overpowered and destroyed by those plants that are common to the soil. When it is kept very closely fed down, it constitutes excellent pasturage for sheep; but when this is neglected, like many other grasses, it gets coarse: if sown with red clover, in the proportion of two bushels of the grass seeds to ten pounds of the clover, it forms a better sward; for as the latter wears out or disappears, the former resumes its place, and lasts

\* *Holcus lanatus*.† *Dactylis glomerata*.



better in the land. It is a grass that vegetates better during the winter season than many others. It affords much seed, and which may be gathered at but little expense, as about four shillings the bushel. It has been found highly beneficial in affording an early feed for sheep.

*Tall Oat-Grass*\*.—This is a grass sometimes found abundantly in meadows. It is early, coarse, and productive; but affords a plentiful aftermath. In excellence it approaches the meadow fox-tail, for which it may in many cases, prove no indifferent substitute. It is cultivated on the continent with advantage.

This, like the preceding grass, is found the most beneficial when retained in a close state of feeding. It makes good hay, and experiment has shown it to afford a greater weight of produce than most other grasses. On the continent, in comparison with common grass, it is found to yield in the proportion of twenty to two.

*Meadow Cat's-Tail Grass, or Timothy*†.—This grass succeeds best in moist soils and situations, is very productive, but coarse and late. It possesses no advantages over the meadow fox-tail. It is the most proper for clays, the moister kinds of loams, and those of the peat nature. When cultivated on moist loams with a substratum of the clayey marle description, it has been found on trial very useful, especially when kept closely fed down by sheep. According to the accounts of travellers in America, it constitutes the principal support of cattle and other animals, wherever the lands are of the meadow kind. It affords plenty of seed, of which a bushel is said by some to be sufficient, when mixed with those of other sorts, to sow four or five acres of land. They are capable of being procured in a perfectly clean state from America, in any proportion, at the easy expense of about a guinea the bushel.

*Hay-seeds*.—These are the seeds collected in hay-lofts and chambers, or from under the stacks; and must of course be a mixture of the seeds of various sorts of grasses both good and bad, as well as of other sorts of plants that may have been upon the land from which the hay was taken. They should consequently never be indiscriminately made use of in laying down lands to the state of sward, as has been the too common practice. The only way in which they can be used with propriety is, by selecting them from the best grasses on the fields after their being cut down, and afterwards threshing them out, as by this means the seeds of the bad and improper plants may avoid being mixed and blended with those that are valuable and of the proper sorts. Another method has been advised by an able practical cultivator, which is that of taking them from such old pasture meadow, or marsh lands, as abound in grasses of the best kinds; being careful that the soils from which they are taken be similar to those on which they are to be sown; and instead of cutting them at the common period of hay-time, to let them stand till the yellow oat grass begins to turn its colour, which being one of the latest kinds, all the others will have attained perfection: they should then be cut down, and afterwards threshed out on a cloth in



the field, or secured to be threshed in the winter season. But in this way, with the greatest care, improper and useless plants may often be propagated.

There are other plants besides these that may be of great advantage in laying down lands to grass, by the large quantity of herbage they produce, such as the following :

*Yarrow* \*.—This is a plant that sends forth a great abundance of leaves, which constitute good herbage, and which are consumed with great avidity by cattle and sheep ; but from the flower-stems being sometimes rejected, it has been too much neglected. It forms the principal herbage in many fine rich pastures, but where they are kept closely fed down is but little perceived. It is predominant on moist, loamy soils, in an equal degree as on those of the dry, burning, sandy, gravelly, or chalky kinds. It is of much utility in resisting the effects of drought in the most dry, parched, close-fed lands ; often preserving the spots where it prevails in a green state, while others are burnt up and become quite brown. It is said to answer well, when cultivated with a view to be fed by sheep. It is therefore a plant of much value, and which deserves greater attention than has hitherto been bestowed upon it. The seeds may be collected in October, without much difficulty, and at the rate of about five shillings the bushel.

*White Clover* †. This has been greatly depended upon by most cultivators, in bringing lands into a state of sward. It is an extremely useful plant on the more rich and dry, sandy and loamy soils, as well as in the clayey and peaty descriptions of land, where they have been well drained from moisture ; but on the more wet and poorer sorts of loamy and clayey lands, it is not by any means so proper or useful, as it is not lasting, but gives place to plants of the aquatic kind, as well as others of an indifferent description. It is supposed by some not to afford so sweet an herbage as broad clover or many other plants : with us it has, however, always been eagerly fed upon both by sheep and neat cattle ; and where closely fed down, we have little doubt of its great utility. That which comes up naturally by the application of manure is said to be much more hardy than that which is sown, as well as more lasting in the soil. It has been justly remarked as a proof of good land, that it runs quickly, of its own accord, to this plant. It may be introduced with most sorts of seeds, and contribute greatly to the success of the cultivator.

Mr. Salisbury thinks this an extremely useful plant, which makes good pasturage and hay, but which thrives only in a loamy soil. It is frequently found wild in waste lands where the soil is good ; and, in fact, he considers it as a just criterion to judge of the fertility of a soil by.

In Suffolk and Essex, according to the account of a late writer, it has been lately cultivated alone for seed with great advantage, affording according to the difference of price from seven pounds to fifteen pounds the acre ; the first crop in this case being seeded which is

\* *Achillea Millefolium.*† *Trifolium repens.*



contrary to the practice with red clover. Some, however, take a spring feeding first.

*Cow-grass* \*.—This is usually known to farmers, under the title of marl grass. It is said to be a more lasting plant than the common red clover. On clayey soils and loamy ones of the stronger kind, it is found to succeed to the greatest certainty. And its cultivation has been attempted on those of the sandy description, with such success as to afford good crops. The seed can always be procured with facility.

It is said to succeed well on all the heavier sorts of soil, and to be of great utility when sown with other grasses, where the lands are to remain in the state of grass. It is recommended to be sown on the stone-brash lands, in large proportions, with other sorts of clover, by an intelligent cultivator.

*Trefoil* †.—This is another plant which is capable of succeeding on soils of different kinds. It may be objected to as being only a biennial; but as it annually sheds much seed, it is said to seldom wear out of the lands on which it is established. This plant is often distinguished by the titles of *Nonesuch*, *Yellow Clover*, &c.

As it is always of much importance to the farmer to have the land he lays down for pasture to produce an ample crop the first year; and as there are some grasses or plants which require two or three years to establish themselves, and acquire their perfect growth, while others arrive at their extreme growth and expansion the first year after they are sown; some of the latter sort should be chosen, among which trefoil will be highly valuable. This proves the advantage of mixing it with other sown grasses. Some think the quantity of four pounds of trefoil seed to the acre is too small; and intend in future either to double it or add as much red clover seed, which may be more proper. In this quantity, it is supposed, they will not injure the others grass seeds sown at the same time, but furnish a copious vegetation until the others come to perfection, at which period both the trefoil and red clover have a natural tendency to disappear or wear out. The seed may be readily procured, and without much expense. It has likewise been found to answer on the stone-brash soils by Mr. Davies. On chalky, and all the drier sorts of soil it is recommended as proper and beneficial.

*Bird's-foot Trefoil*.—This has been found useful for cultivation in meadows which are inclined to moisture, as growing to a great height, and affording good hay. It is cultivated in Herefordshire as pasturage for sheep.

*Rib Grass or Rib-wort Plantain* ‡.—This is a plant much relished by neat cattle and horses; and on grounds that are rather soft and porous, as sands and loams, in good heart, and which have a tendency to moisture, it affords a large produce of herbage; but on those that are very dry and binding, its produce is but scanty. But on these it is asserted to answer for sheep-pasture, though inferior to others. It has been long established in some districts, where it is in much

\* *Trifolium medium*.

† *Medicago lupulina*.

‡ *Plantago lanceolata*.



esteem for sheep-fed, but from its succulent nature improper for hay.

According to a late writer, it seems a good plant for thickening the bottom of the grass. Cattle are said to have a dislike to it, by some; but certainly the flowering-stems are here eagerly eaten by all sorts of stock. It is early in flower, and flourishes particularly in moss lands that have been drained in a perfect manner. It affords seed in great plenty. *The Grass-leaved Plantain*\* is also a plant capable of being employed with advantage in the laying down lands to pasture. It is said to succeed on barren soils and clays. It has the property of resisting the effects of the sea air, and, as growing well on land liable to be covered with salt water, may be a valuable plant in such sorts of ground. Its leaves, from their smallness, have the appearance of the thicker and better sorts of grass. Both cattle, sheep, and horses, feed upon its leaves with much greediness, but particularly sheep, which pare it as close as possible. It affords much seed, which is capable of being easily collected.

*Burnet*†.—This is a plant which has a perennial root that strikes deep into the soil, with a stalk a foot or more in height. Though the utility of it as a field grass has been disputed by some, it is shown by the repeated trials of others, that it may be had recourse to with much advantage on such soils as are suited to its growth, as those of the sandy, clayey, peaty, and chalky kinds.

*Seed.*—In the culture of the plant it is of vast importance to have good seed, and that which is of the proper sort. It may be the best procured by selecting a part where the plants are good, as they afford it in a large proportion. Where the land is intended as a sheep-pasture it should be sown broadcast over the ground; but in other cases it admits of being cultivated in drills, in the same manner as lucern. The proportion of seed which is necessary is mostly about one bushel to the acre.

*Time of sowing.*—The most proper season for sowing this sort of grass seed is in the early spring, as in April; in which case it is usually sown with barley or oats, being covered in by two harrowings. It may likewise be sown in May with buck-wheat with much propriety. It has also been suggested, that it may be sown so late as the latter end of July or beginning of the following month, on land that has failed for turnips. It answers very well when mixed with ray-grass or cock's-foot grass seeds in the proportion of one bushel of either of them to three pecks of the Burnet seed.

*After-management.*—It requires but little attention after it has been put into the soil, except being kept clean, till the periods of its being mown, when left for that purpose, which is in July, when care should be taken in cutting it, as the seed is liable to shed. It should be threshed out in the field, where it can be done with convenience, in the same way as cole seed; the straw being made into hay. After it has been mown for seed or a second crop of hay, the stock should be kept from it during the whole of the autumn and winter, that there may be a full bite for sheep in March, which is

\* *Plantago tenuifolia.*

† *Poterium sanguisorba.*



its peculiar advantage, and the circumstance upon which its utility in a great measure depends. Under the contrary management it is much less beneficial.

There are many other plants, both of the tare or vetch and sweet pea, as well as other sorts, that are said to have been found highly valuable, especially when kept closely fed down by cattle; but the trials that have yet been made with them are much too few to allow us to speak of them in this place.

The different field-grasses and herbaceous plants which have been described above, may be arranged and found useful in respect to soil, allowing for particular circumstances, somewhat in the following order: for

*Clayey Soils.*—Marl or cow grass; rough cock's-foot grass; crested dog's-tail; meadow fescue grass; meadow fox-tail grass; rough-stalked meadow grass; tall oat grass; trefoil; meadow soft grass, or Yorkshire white; and meadow cat's-tail, or Timothy grass.

*Loamy Soils.*—White clover; ray or rye grass; meadow fescue grass; meadow fox-tail grass; crested dog's-tail grass; poa or common meadow grass; meadow soft grass, or Yorkshire white; meadow cat's-tail, or Timothy grass; smooth-stalked meadow grass; sheep's fescue grass; hard fescue grass; Yarrow, and lucern.

*Sandy Soils.*—White clover; ray or rye grass; meadow soft grass, or Yorkshire white; sweet-scented vernal grass; sheep fescue grass; Yarrow; Burnet; trefoil, and rib grass.

*Chalky Soils.*—Yarrow; Burnet; trefoil; white clover, and saint-foin.

*Peaty Soils.*—White clover; crested dog's-tail grass; rough cock's-foot grass; rib grass; meadow soft grass, or Yorkshire white; ray or rye grass; meadow fox-tail grass; meadow fescue grass, and meadow cat's-tail, or Timothy grass.

Considerable latitude must, however, be allowed in the use of these, both on account of the variations of soil, and the differences in the states of preparation in the lands, as well as the convenience or difficulty of procuring the seeds of them.

*Early Herbage.*—In this point of view they may also stand somewhat in the following manner; sweet-scented vernal grass; meadow fox tail grass; smooth-stalked meadow grass; rough-stalked meadow grass; tall oat grass; rough cock's-foot grass; hard fescue grass; Burnet; rib grass; ray grass; trefoil, and broad-leaved clover.

*Abundant Produce.*—In this respect the following order may perhaps be proper: ray grass; tall oat grass; broad clover; Burnet; meadow cat's-tail grass, and meadow fox-tail grass.

Too few experiments have yet been made with regard to the differences in the feeding properties of different grasses, to afford any correct arrangement of them in that view; yet, as distension, as well as the nutrient principle, is requisite in the support and fattening of all animals, it may not be improbable but that those grasses or other plants that abound in sweet-jointed stems, and at the same time afford much foliage, may be the most nutritious. The supe-



nor utility of those grasses that run much to stem, as well as of broad clover, tares, and other similar plants, in the support of different sorts of stock, seem to countenance the supposition. And it is probably on the same principle that the first crops of hay are better capable of supporting work-horses than those which arise from the soft laxative herbage of the aftermath.

*Grass-Seed.*—As most of the best grass-seeds may now either be purchased in the seed-shops, or be easily obtained in the manner that has been mentioned above, there will of course be much less difficulty in laying down land with proper grasses than was formerly the case.

In respect to the proportion of seed that may be the most proper and advantageous under different circumstances, it must depend in a great measure upon the nature of the soil, the situation of the land, the state of preparation to which it has been brought, and the intentions of the cultivator in its application. But old tillage lands will in general require a much larger proportion of seed than those which have been more recently broken up. Cold exposed situations also stand in need of a greater quantity of seed than those that are low and warm; and where the lands are designed for pasture a larger proportion than where hay is the principal object.

*Clayey Soils.*—On these some advise the following proportions as the most proper; marl or cow grass, 5lbs.; trefoil, 5lbs.; crested dog's-tail grass, 10lbs.; meadow fescue grass, one bushel; meadow fox tail grass, one bushel. And where the three last cannot be procured, meadow soft grass, or Yorkshire white, two bushels; meadow cat's-tail, or Timothy grass, 4lbs.: or meadow cat's-tail, or Timothy grass, 4lbs.; and Yorkshire white, one bushel.

Others recommend, on the heavy sorts of lands that are to be broken up in a year or two, from ten to fourteen pounds of red clover; but where they are to remain in permanent grass, marl or cow grass, from 4lbs. to 6lbs., and white clover, 4lbs.

*Loamy Soils.*—These are supposed to require the following proportions by some experienced cultivators: white clover, 5lbs.; crested dog's-tail, 10lbs.; ray grass, one peck; meadow fescue grass, three pecks; meadow fox-tail, three pecks; Yarrow, two pecks. Or where the second cannot be had, ray grass, one peck; rib grass, 4lbs.; and in the room of the last three, meadow soft grass, or Yorkshire white, half a bushel; meadow cat's-tail, or Timothy grass, 4lbs.; marl or cow grass, 5lbs.

There are others, however, that advise, on all dry soils, white clover, 4lbs.; marl or cow grass, from 4 to 6lbs.; and of hop or yellow clover, from 2 to 4lbs. And for permanent pasture it is the practice of an intelligent farmer in Devonshire to sow white clover, marl or cow grass, and hop or yellow clover in the quantity of each from 6lbs. to 7lbs. with the best ray grass, in the proportion of one bushel. In this method a constant succession of food is supposed to be preserved for five or six months in the year; as the hop clover and rye grass flourish in the early part of the spring, the marl or cow grass being in perfection in about the middle of summer, when the former begins to disappear, and the white clover becomes in its



perfect state a month or six weeks later, continuing through the rest of the season.

On such loams as have a substratum of the stone-brash kind, it is recommended by an experienced agricultor, to sow per acre: of ray grass, one bushel; marl or cow grass, 10lbs.; white or Dutch clover, 3lbs.; hop clover, or trefoil, 1lb.

Without discriminating the particular kind of soil, Dr. Wilkinson, who has had much experience, recommends the use of white clover in the proportion of 12lbs. broad clover, trefoil, and rib grass, of each 4lbs.

*Sandy Soils.*—On this description of land, the following proportions have been found by some the most useful: white clover, 7lbs.; trefoil, 5lbs.; Burnet, 6lbs.; ray grass, one peck; Yarrow, one bushel; or, instead of the last, rib grass, 4lbs.; ray grass, one peck.

But on the same sorts of soil other experienced agriculturists only make use of white clover and trefoil in the proportion of 5lbs. each, with a bushel of ray grass, and about an equal quantity of collected grass-seeds to the statute acre.

As grasses, even in the richer sorts of lands of this nature, are liable to be much injured by the moisture being too quickly conveyed away in the summer season, it would seem proper to put in a full proportion of seeds in all cases. On the poorer and thinner sorts, the quantities recommended in the above cases may often be augmented, especially in the Burnet and ray grass, with advantage.

*Chalky Soils.*—These are found to succeed with the following quantities: Burnet 10lbs.; trefoil, 5lbs.; white clover, 5lbs.; Yarrow, one bushel; or in its place, ray grass, one bushel.

On this description of soil, Mr. Boys, an intelligent cultivator of much experience, advises rib grass, 8lbs.; white Dutch clover, and marl or cow grass, each 4lbs.; and yellow trefoil, 4lbs. He also speaks highly of the use of saintfoin in such cases. And as in this, as well as the preceding soil, the grasses are apt to be injured by the heat of the summer season, the land should constantly be well stocked with grass plants.

*Peaty Soils.*—In this sort of land the proportions of seed advised below are found to succeed well by some: white clover, 10lbs.; crested dog's-tail grass, 10lbs.; ray grass, one peck; meadow fox-tail grass, two ditto; meadow fescue grass, two ditto; cat's-tail, or Timothy grass, one ditto: or in the places of the second, fourth, and fifth, meadow soft grass, or Yorkshire white, six pecks; rib grass, 5lbs.; marl or cow grass, 4lbs.

An able and experienced agriculturist thinks it a matter of the greatest importance, that a full quantity of seed should be sown in all cases where the land is intended for pasturage.

In the laying down land for the purpose of good meadows, the following proportions of these different grass seeds have been recommended per acre, for lands that are of the moister kind: meadow fox-tail grass, and meadow fescue grass, each two pecks and a half; rough-stalked meadow grass, and smooth-stalked meadow grass, each a peck and a half; crested dog's-tail grass, and sweet-scented vernal grass, each three quarters of a peck; white or Dutch clover,



and wild red clover or broad clover, each one peck and a quarter. Where the grounds are much inclined to moisture, the crested dog's-tail grass and smooth-stalked meadow grass may be left out. These are said to soon form a good turf; and, from their being hardy perennials of vigorous growth, are not liable to be overpowered by the coarse indigenous plants of such lands.

In lands which are to be conducted under a convertible system of corn and grass, it will in most cases be the most advisable practice to sow seeds of the artificial grass kind, as broad clover, saintfoin, &c. according to the nature of the soil, with those of white clover, ray grass, and some others.

In cases where the lands are to be kept in a permanent state of sheep pasture, though it has been advised by some to have recourse to the finer sorts of grasses, it is probably a matter of less importance than has been commonly supposed, as the coarser sorts, when in a state of sufficiently close feeding, become gradually finer and better; but in order to produce this effect in the fullest manner, they should constantly be so eaten down, as to prevent any of the seed-stems from advancing. The tall oat grass, the cock's-foot grass, and the meadow soft grass, have, under this sort of management, become sufficiently fine, and the same effect has long been known to be produced on rye-grass, by the close eating of it down by animals.

*Time and Method of Sowing.*—In accomplishing these different operations, different modes are practised, according to the manner of preparation and the particular circumstances of the land. In respect to the first, or the periods of putting in the grass seeds, the most usual has been in the spring, at the time that the grain crops are sown; but where the ground has been brought to a suitable state of preparation by means of green or other fallows, the latter end of the summer, as about August, has been the more general season. In the former case they are commonly put in with the grain crops; but in the latter, without any other sort of crop. There has been much diversity of opinion among agricultural writers with regard to the superior utility of these different seasons of introducing the seeds, as well as with regard to their being sown with or without other sorts of crops. The advantages of the autumnal over those of the vernal sowings are contended to be, those of the grass plants being less exposed to danger from the shade, closeness, and choking that must necessarily occur at the latter season; there being less risk of stocking the ground with noxious weeds in case of the seeds of hay chambers being indiscriminately sown; their being put in upon a better preparation and more mellow and fertile state of the land; their growth being more strong and vigorous from their not being robbed of their proper nourishment by other exhausting crops, and the great superiority of the hay produce: while on the contrary it is maintained in support of the vernal sowings, that besides their being less precarious, shade is necessary in the early growth of the grass plants to protect them from the effects of heat; the moisture is better preserved in the soil for their support; small annual weeds more effectually prevented from rising to injure them; and the loss the farmer must sustain from the want of the grain crop guarded against.



But though some of the arguments urged on both sides of this controverted point may be objected to, the autumnal sowings not preventing the perennial weeds from rising and shedding their seeds in the following summer, nor the great closeness of grain crops being without injury to the growth of the young grass plants; there are facts that render it not improbable but that each method may have advantages under particular circumstances. In the more southern districts, where the severity of the winter season is later in its approach, the autumnal season may frequently be made use of with advantage, after fallow crops, for sowing grass-seeds, especially in cases where the lands are in too rich a condition for the successful growth of corn. But in the more northern parts of the kingdom, and exposed situations, where the frosts set in at an early period, it may be in general the most advisable practice to put the seeds in, in the vernal months, with suitable crops of the grain kind. An intelligent writer of much experience has indeed observed, that grass seeds answer almost equally well in either method: he prefers the August sowing without corn, though the success of his trials in the different seasons has not justified any decisive conclusion. It is even admitted that in moory and mountaneous situations, where the snows come early, autumnal sowings are not advisable, or to be performed later than the very early part of August; the vernal season with oats for being cut young for soiling, or hay, is constantly to be preferred. Mr. Dalton, in Yorkshire, after trying other methods, recommends the autumn without corn as the most advisable. And the Reverend Mr. Close states that “a friend of his, wishing to procure a good meadow or pasture around his house, fallowed the land for barley; but the spring proving wet, and the soil being a strong loam, he could only put half of it in order for that crop, which was sown and laid with clover and rye grass. The other part was fallowed, and sown in August with the sweepings of hay chambers. The barley was a good crop, and the clover and rye grass were probably equal to the first year’s cut of hay. The second year the artificial grasses began to fail; worse the third, fourth, and fifth: the sixth year, after having received two dressings, the spontaneous product of the soil began to give a fleece over the surface of the land. About ten years after these lands were sown, Mr. Close saw this field, when the part sown in August was worth at least fifteen shillings per acre more than the part which had been sown with artificial grasses in the barley. Thus from actual experiments, numbers of which he could adduce, he concludes that sowing the sweepings of hay chambers in August is preferable to sowing artificial grasses in the spring with any crop of corn. Suppose, says he, the corn worth five pounds per acre, the difference in the produce in hay or seed in the second, third, fourth, and fifth years, would more than counter-balance this; and the proprietor would find a permanent improvement in his land of from fifteen shillings to twenty shillings per acre.”

On comparative experiments being made with corn in the spring months, and without it in August, the latter was found by much the best mode by different cultivators, as Mr. Lyester in Lincolnshire, and Mr. Burgoyne in Essex.



But in the experiment of an accurate agriculturist, mentioned by the Rev. Mr. Young, in comparing different methods of vernal sowings, in which four acres were sown with seeds alone, on peas and buck-wheat ploughed in the preceding autumn; five acres with barley; and five more with the seeds put in alone without corn or manure: the portions sown alone were overrun with weeds, and only preserved from being smothered and destroyed by being eaten down by a dairy of cows. And others, after repeatedly trying the experiment of sowing in the spring with corn and the autumn without, and from long and extensive practice, conclude, “that, even if we were to have no regard to any other circumstance except the grass crop alone, it would always be best to sow it with some kind of grain; but when we consider likewise the loss that the farmer thus sustains for want of a crop of grain; the practice of sowing alone must be looked upon as highly pernicious to the farmer.”

It is probably in this last respect that the greatest disadvantage of the practice consists, as without it the farmer can derive no immediate recompence for his great expense of tillage and preparation of the land.

Where the vernal sowing with other sorts of crops is had recourse to, barley is that which is the most usually recommended, and “there seems to be no question that barley is in general the fittest grain to be sown with grass-seeds. The same tilth which answers for the one is requisite for the other. Barley has a disposition to loosen the texture of the ground in which it grows; a circumstance highly favourable to the vegetation of grass-seeds, which require a free and open soil to extend their roots in; the tender and delicate fibres of which have much difficulty in contending with the resistance of a stubborn soil. And this points out the reason why grass-seeds so frequently fail on strong land not in a proper state of cultivation. In the choice of barley, that sort should be preferred which runs least to straw, and which is the soonest ripe.” But as from the grassy nature of the stem, and the large size of the ear in this sort of grain, a considerable degree of closeness and shade must constantly be kept up, it should never be sown so thickly as in other cases where there are no grass-seeds. Some object to sowing grass seeds with barley on other principles—as those of its drawing its nourishment from the surface, which is also the case with the grass plants, and that in consequence they must be greatly retarded in their growth from the want of due support. Where the land is in a proper state of preparation and tillage, if sown with oats, they will be apt to become so luxuriant as to greatly injure, if not wholly destroy, the young grass-plants by the closeness of their shade. In some cases they, however, succeed tolerably with this sort of crop. On the stronger kinds of land the sowing of grass-seeds, has been found to answer well with thin crops of beans. In an experiment of this kind, Mr. Dalton found that the beans did not “rob, but sheltered and nourished,” the grass-plants, the plan answering beyond his expectations.

The importance of having the surface mould in a fine state in order to the more regular distribution and more perfect vegetation



of the grass-seeds, has been already noticed. But to effect these purposes in the most complete manner, the seedsman should be accustomed to the business, and the seeds, as being of different weights, as little mixed with each other as possible. It is much better to have more casts than to blend the seeds together for the sake of dispatch.

For all the smaller sorts of seeds, it has been suggested as preferable to deliver them by means of the Norfolk turnip trough, which has lately been adapted to clover and ray grass. This operation should always be performed as soon after the land has been ploughed as possible, as under such circumstances the seeds vegetate in a much more quick and vigorous manner. But it should never be attempted in such a wet state of the land as produces any great degree of tenacity or adhesiveness in the mould, as in such circumstances the seeds would be apt to come up in a tufty unequal manner. Nor for the same reason should the lighter sorts of grass-seeds ever be sown in windy weather; as the delivering them in an equal and regular manner is a point of consequence to the forming of a good grass-land. In the covering in of the seeds, care should be taken that none are left in a exposed state on the surface of the ground, as when that is the case many of them will be destroyed or picked up by birds, and the sward appear patchy. This business is executed in the most complete manner by a pair of light short-tined harrows at one tining. The practice of employing bush harrows is improper, as in that way the seeds are liable to be drawn into lumps. In all the lighter and more spongy descriptions of land, it may be advantageous to pass a light roller over the surface immediately after the seeds have been well harrowed in.

In cases where the tenants and not the proprietors of the lands are to lay them down to grass, it may be the most advisable practice for the latter to procure the seeds; but at the expence of the former; especially where they have a sufficient interest in such lands,—as, without this precaution, from their general propensity to keep the grounds under the plough, and their indifference in respect to the obtaining of the most proper sorts of seeds, there may be danger of the business being improperly performed.

*After-management of new Grass Lands.*—This is a matter of considerable importance, and upon which much of the success of forming good grass land depends.

As soon as the crop with which the seeds have been sown has been removed, it is advised by some to have recourse to rolling the land with a moderately heavy roller, when it is in such a state of dryness as just to admit the impression of the implement; as by this means, from the mould being pressed closely about the roots of the plants, their early growth may be much benefited, and the danger of drought prevented. The practice is, however, the most necessary in the more light and porous descriptions of land. Others likewise recommend the application of manure at this period, in order to promote the growth and support of the young grass-plants; but this would seem quite unnecessary when the mode of preparation that has been just described has been attended to.

As the surface of such grounds as have been newly laid down to



the state of sward is, from the previous tillage which they require, extremely tender, and readily broken into holes for some time even in the drier descriptions of land, the turning in of cattle with the view of feeding them down must in most cases be highly prejudicial by the treading which they cause. The best practice is therefore probably to suffer no sort of stock to be put upon such lands till the spring after their being laid down; or where the farmer finds it absolutely necessary to turn upon the lands, the lightest sort of stock should constantly be selected for the purpose. It has been observed that the advantage of feeding such lands during the autumn and winter seasons is scarcely a matter of any consequence, as the spring feed for sheep, where it is omitted, is of so much greater utility, a very early pasturage being in this way afforded for ewes and lambs.

As to the advantages in the succeeding management that may be had recourse to, in different cases and circumstances, there is much contradiction in the opinions of different experienced cultivators, some maintaining the superiority of keeping the ground closely fed down by sheep or neat cattle, while others conceive mowing or feeding as preferable. There seems little reason to doubt but that feeding by some sort of stock is a much better practice than those of either mowing or feeding; the chief difficulty is in respect to the sort of stock that is the most proper. On the more dry and firm sorts of ground a mixed stock may be the most advantageous, as neat cattle and sheep, as in that way the new pasture may be fed down in the most regular manner; but on those that are of a more open, porous, and less firm quality, sheep, by their eating so closely, may do much harm, especially in the first years of the new lay, by pulling up the young and imperfectly established grass-plants. Several instances of this kind we have noticed in such soils. In lands that are more inclined to moisture, the consuming of the produce by neat cattle must constantly be liable to do mischief, except in very dry seasons; they must of course be principally fed down by sheep. And in all cases where the new lay is chiefly constituted of the more coarse sorts of grasses, sheep would seem to be the most proper kind of stock, as the grasses are thereby constantly becoming more fine and sweet. Many facts of this nature have been noticed by cultivators. The sweetness of the pasturage on many sheep downs has been remarked to depend more on their being kept close fed down than any other circumstance, as on being neglected in this respect it becomes coarse, and is rejected. It has been well observed, indeed, that "sheep-feeding not only ameliorates by enriching the soil, and finishing the herbage, but also by destroying weeds." We have been assured by a very extensive and experienced cultivator in Somersetshire, that under this sort of management, not only many coarse grasses but other sorts of plants become fine, and eagerly fed upon by animals.

Doctor Wilkinson, who has been much in the habit of comparing different practices, advises the grazing constantly with sheep, and for the first six years never to permit the scythe to touch the lays. And the Reverend Mr. Young has well observed, that it is not merely the first year that feeding with sheep is the best practice on new



lays, but it may be so managed the second, and if it extend to the third it is the better: and though there is not any necessity for adhering to it any longer, it has been found to answer well in his practice, four, five, or even six years; and in general he thinks it may be concluded, that the more the land is fed with sheep, the greater the improvement will be. But in this management the impoverishing absurd system of removing the animals to be folded in other places, is not to be had recourse to.

It has been long the practice in many districts with the most improved cultivators, to have recourse to the method of sheep-feeding for some time after laying the lands down to grass, as two years or more. And where ray grass and white clover are intended to remain some years, it is found, by some, advantageous to eat them the first year by sheep, in closing, thickening, and rendering them more permanent. These facts are all in evidence of the great propriety and utility of the practice of feeding new grass lands. It must however be observed, that in order to render the practice as safe and beneficial as possible, the new lays should not be fed during the autumn, or the stock turned into them at too early a period in the spring. Nor should they be too heavily stocked, or the stock kept in the pastures too long, especially when it consists principally of sheep, as they may do much harm by paring and eating the plants so closely down, as immediately to kill them, or expose their roots too much to the destructive effects of drought. And in cases where the grasses have run up much to stem, if the lands be sufficiently stocked with plants, it may be an useful method to cut them over by means of a strong scythe before their seeds are formed, as by this means they will become more strong and vigorous: but in the contrary circumstances, they are better left for the purpose of providing a more abundant supply of young grasses, as the benefit obtained in this way will more than counterbalance the injury sustained by the running up of the old plants.

But though the practice of feeding new laid grasses in the first years appears to be the most advantageous and proper mode of management, especially for lands intended for pasture, there are many cases in which they may be mown with great success. This practice is perhaps always the most beneficial and proper, and indeed the only one that can be safely adopted in such soils as possess any great degree of moisture, as under such circumstances the feeding them down with any sort of live stock must in most seasons be injurious to the sward. And, besides, where the object and intention of the farmer is chiefly hay, the grass-plants, by being kept closely eaten down by live stock for a considerable length of time before the scythe is applied, may, from their becoming thereby disposed to a low and lateral spreading growth, be afterwards more unfit for the production of hay crops. Several facts of this nature are related by writers on husbandry. In one case, where different divisions of land of the same kind were laid down in the same manner, on one of them being kept in a state of pasture and the other alternately mown and pastured, after some years both being shut up for hay, that which had been pastured afforded a much inferior produce to the other.



The same thing has happened in other cases of old pastures being converted to hay lands, even when the most favourable season prevailed.

On these principles it may be a more judicious practice to manage lands designed for hay without having them for any great length of time, previously to their being mown, fed closely down with stock, as in this way a larger produce of hay may be afforded.

Where the new lays are mown the first year after being laid down, which is not a method to be generally recommended, it is an excellent practice to apply a moderate coat of manure over them in the autumn, especially when the state of the land and the season is such, in respect to dryness, as to admit of its being done without injuring the surface sward; as by this means the grass-plants not only become more strong and vigorous, but better established in the soil, and of course bear cutting with much less injury.

As it may sometimes happen, though it can be but seldom, where the methods that have been detailed above are fully attended to, that the cultivator may fail either in part or wholly of producing a good lay: in the first case it is the best practice to have recourse to sowing fresh seeds, which should be performed in the early part of the spring, when the weather is in a moist state, the seeds being advised by some to be trodden in by putting sheep upon the land either indiscriminately, or by very open folding, as the use of the roller will not be effectual, and that of harrowing cannot be practised without injury. Doctor Wilkinson has found advantage from putting the seeds in before the manure was applied in the new lays, which are sometimes too hastily ploughed up. By either method the sward of such lays may often be much thickened and improved.

And in cases where the grasses have run up much to stem, if the lands be sufficiently stocked with plants, it may be an useful practice to cut them over by means of a sharp scythe before their seeds are formed, as by this means they will be more strong and vigorous and the lands be less injured; but in the contrary circumstances they are better left for the purpose of providing a more abundant supply of young grasses, as the benefit obtained in this way will more than counterbalance the injury sustained by the old plants.

Where there is a complete failure from particular causes, the most advisable practice is, in cases where the seeds have been put in in the spring with grain crops, to take off these crops as soon as they will admit of it; and after giving the land one ploughing, directly to harrow in fresh seeds. The business should be accomplished as early in the beginning of August as possible. A roller may be applied over the land when in a suitable dry condition about October. But where the latter end of summer has been the period of sowing, it is recommended that the land should have three ploughings performed upon it in the early spring months, when the weather is sufficiently dry, and the grass-seeds be again put in with a crop of buck wheat in May, which, though it is not a suitable crop for the heavy wet sorts of land, sometimes answers well in dry seasons; and in wet ones, as affording but little seed, may be mown when in blossom as a



green food for cows. From its not robbing the land much of its fertility, it is well adapted for the above purpose\*.

In regard to the application of manure to new laid down grass lands, though it will seldom be absolutely requisite, where they have been returned to the state of sward under the degree of fertility and preparation that has been already advised, it may in most cases be had recourse to with great advantage and improvement, as it is probably one of the best means of preserving a good close state of sward when judiciously employed. It has been remarked by an experienced cultivator, that though in general no manure will be wanted till the land has been mown for hay, there can be little doubt but that great additional improvement will be produced where manure of any sort can be applied, and that "the oftener the land is manured the greater will be the improvement."

If the lands have been laid to grass with corn crops, the application of a slight dressing of manure in the autumn following may, as has been already seen, be of great utility in fixing and encouraging the growth of the young grass-plants; but in other cases the latter end of the summer following, or very early in the autumn, are supposed by some to be the most beneficial periods for the purpose: but as at these times, in many instances, much loss of manure may be sustained both by evaporation, and the washing of heavy rains and snows, it may be a better and a more advisable practice to perform the business in the early spring months, especially where the lands are to be conducted under the scythe, as in this way the enriching material will be ready to exert its influence at the moment the young plants begin to send forth their new shoots; and thus not only afford more assistance in thickening and invigorating the new sward, but be less in danger of being uselessly dissipated and wasted.

But where manure cannot be spared for repeatedly dressing new grass lands, as the grasses are often, especially on lands not well suited to their growth, liable to decline and become thin, in some instances it is supposed from the sown grasses disappearing before the spontaneous ones have attained sufficient vigour and strength, but more generally, probably, from the grounds not having been in a proper state of fertility or fineness of surface mould at the time the seeds were put in, or the particular unfavourableness of the season, about the close of the third summer after their being sown, it is believed to be a better practice to defer the use of manure till that time on such lays as are pastured; and when they are under the scythe, till the hay crop has been taken from the ground. We have no doubt of the success of the application of dung top-dressings at these periods, though they must evidently be made use of in a less economical manner than at a later season in the autumn, or an earlier one in the spring. And it is the most common opinion that all the finer and more soluble kinds of top-dressings are applied with the greatest benefits in the very early spring months, as about the latter end of February, or the beginning of the following month.

\* Section on Manures.



The differences in the effects of these sorts of manure have, perhaps, not yet been fully ascertained.

In encouraging and supporting the growth of the natural grasses when the sown ones decline about the third year, an experienced cultivator, who seems to favour the opinion of manure being the most usefully laid on land early in the autumn, or on hay lands immediately after the crops have been taken off, states that he has "used coal ashes with great success, to the amount of three chaldrons per acre. He has laid of this manure on grass land above 50 chaldrons in a year. About eight years ago he laid down a field of 12 acres with broad clover principally, intending it to stand for only two years. In the summer it was mown twice, next year it was grazed; the clover was but weak. As he had particular reasons for altering his mind, and for wishing it to continue in grass, he resolved to try the effects of grazing it with sheep. On the fourth year it looked so very bad, the clover almost disappearing, that he was tempted to plough it up. He, however, resolved to continue the grazing, and to give it a dressing of three chaldrons per acre of coal-ashes. The next year he observed the white clover and natural grasses beginning to form a close turf, and the field is now an excellent piece of sward, without the aid of any hay-seeds."

It would appear from the further trials of the same intelligent agriculturist, that the following substances have much effect, not only in promoting the growth and rendering the herbage more fine and sweet, but in renovating the sward.—"The scrapings of the road, or sand drift, are, he says, of great service in producing a sweet herbage. Wherever the sweepings of his own walks have been laid on an adjoining common, he has observed the coarse grass disappearing, and the fine bents showing themselves. He has a field now in his own occupation which, from a piece of coarse herbage, has been brought into such a luxuriant state of sward that it is esteemed the best piece of grass land in the parish. The improvement was in part owing to its situation near a brook, which brought down from a contiguous common a quantity of leaves and sanddrift: these were carefully collected and laid on the meadow every year."

And he has used fold-yard liquor with advantage.—"Having laid down a field to grass immediately adjoining his fold-yard, which was situated above it, by means of pipes and trenches he had the liquor from the fold-yard conducted over the field, after having collected it in a reservoir; the effect of it in destroying coarse grass, and producing a sweeter sward, was very remarkable."

The effects of watering have likewise been found powerful in the reproduction of sward; "and where it can be had at command, land may with great facility be broken up for corn, and afterwards returned to a state of meadow. In two different meadows, which during the winter were frequently flooded, he has pared off part of the turf, and has observed that the ground became green the first year, and on the second it was so covered with grass that he could with difficulty distinguish where the sward had been taken off. He has known the same land pared a second time in three years, and



speedily covered again with a coat of sward after having been frequently flooded."

The effects of the following manures, according to the experience of the same cultivator, would seem to be chiefly in promoting the luxuriance of the grasses, and of course to be principally advantageous in respect to the quantity of produce. "Tallow-chandler's graves on being used to the amount of a ton an acre, at half-a-crown a hundred weight, the grass was rendered so rank that for some time cattle would not touch it, and the hay was too coarse for sale. On account of its rankness he generally uses it mixed with mould or ditch earth. Its effects are visible for some years after it has been laid on in the superior verdure of the grass."

It is observed, that the effects of "night-soil have been abundantly proved both in Flanders and the neighbourhood of London. The quantity used on grass land is about three loads to the acre. It is a stronger and more permanent manure than common dung."

In the fixing, producing, and rendering the white clover more permanent, the following substances have been found by the same gentlemen to have considerable powers. On "the application of marle he mentions one fact, which is, that he has known it successful in fixing white clover on strong cold land, from which it is very apt to disappear. He has likewise found folding of great advantage in fixing and forwarding the white clover. Coal-ashes will, he says, produce this clover on wet land; but unless the land is drained, it will soon grow weak or disappear." It has also been observed, that on the dryer clayey lands in Cornwall, "sea sand is found to mellow the clay and make them hold the grasses." And on what are often termed stone-brash lands the use of marle is found of great utility, when applied in the latter part of the summer in the first year of the lay. But it is necessary, to the success of this sort of application, that the ground be well covered with grass before it is applied, as where the surface is much exposed the marle is liable to plaster and cake together, and the young grass-plants to be in consequence exposed to much injury from the heat of summer. This substance seems to bring up the best sort of natural grasses. In time this is, however sunk below the reach of vegetation. About thirty cart loads are sufficient for the acre. And chalk on the deep loamy clays is found an useful application the first year on new lays, in the proportion of about twenty loads to the acre. And on the more sandy descriptions of land clayey marle may be of great advantage in establishing the grass. On peaty or moory lands marle and other similar materials will be of advantage in rendering them more compact, and better suited for preserving the grasses; and the sand and road stuff for fining the herbage.

The advantages from the two following substances do not seem so important. Soot has been much used as a top-dressing, but Dr. Wilkinson has not observed "the effects to last beyond the first year. He has tried it to the amount of sixty bushels per acre, at 8*d.* per bushel; perhaps it should be used in larger quantity. Lime is nearly as dear, and of that he has used 160 bushels per acre on ara-



ble land. If he uses soot again he intends to lay it on to that amount. But he has used sugar baker's scum with great success to the amount of two loads an acre, at half a guinea per load, which has been found a strong warm manure, highly serviceable on cold land, its effects being permanent." Lime is found useful on the more friable red loamy soils, by fixing and rendering them more close, to keep the vegetation more to the surface, as well as to promote the growth of the natural grasses, and prevent their roots from being injured by the heat of the sun.

The following materials are probably chiefly useful in protecting and nourishing the young grass plants in their more tender growth; but they are more slow in producing their beneficial effects.—“Woollen rags, though not generally used as manure on grass land, yet, when chopped small, have been spread with advantage on young clovers before winter to the amount of about 10 cwt. per acre.”

On applying, in order to compensate for an immediate crop of hay, and to thicken the sward, on one part of a field rotten dung about eight tons to the statute acre; on another part woollen rags chopped at the rate of 100 stones to an acre; and on the third a rich marle in the proportion of about 80 tons to the statute acre, Dr. Campbell, on comparing their effects two years after their application, found that “the dung had produced the greater luxuriance. The woollen rags had a superior verdure, a deeper green: but as they had not yet been properly incorporated with the land, by the grass growing over them, their ultimate produce could not be ascertained. An acre of land may, he says, be manured by this means for about 3*l*. effectually, should they be found to answer the purpose.” The same is the case with “the marle, which having covered the ground into which it is not yet carried down by the rains, and the grass not having grown through, it has at present rather done harm than good.” On this account it is supposed that marle is long in producing its beneficial effects, and the return of which cannot be looked for in less than two or three years.

These facts sufficiently show that different effects may be produced on grass lands by the application of different sorts of substances to them in the manner of top-dressings after they have been laid down. That where fine herbage is the principal object in view, coal ashes and composts of the earthy kind, formed from sand, mud, scrapings of roads, and other similar materials, intimately blended and incorporated with suitable proportions of well rotted dung, may be the most advantageous applications. The liquor of fold-yards and water may also be useful in the same intention, as well as those of restoring the swards, and promoting the luxuriance of the crops. But where the increase of produce is chiefly intended, good dung in a well reduced state, tallow-chandler's graves, night soil, chopped rags, soot, scum of sugar, and other manures of the more animal kind, are the most beneficial and proper. In other views, as those of establishing and preserving the different grasses—marle, lime, chalk, the folding of sheep, and other substances and operations of the same nature will be the most suitable for producing such effects. And in rendering the lands more firm and solid, the last three sub-



stances may probably be had recourse to with the greatest benefit and success.

## SECTION XVIII.

### *Cultivation of Arable Land.—Artificial Grasses.*

THE methods that seem the most advantageous in restoring different sorts of tillage lands to the state of grass, as well as those which appear the most proper for afterwards bringing them into the most perfect state of sward and productiveness, having been explained in the preceding section, it may be necessary to describe the modes of culture that are best suited to the rising crops of the artificial grass kind, and the means of consuming them with the greatest chance of profit and advantage to the farmer.

*Artificial Grasses*—The general introduction and interposition of crops of artificial or sown grasses between those of the corn kind is a practice of the greatest utility and importance, as the lands are thereby not only prevented from being so much exhausted as would otherwise be the case, and at the same time rendered fit for the growth of particular kinds of grain without the necessity of fallowing, but a much larger proportion of green and other food than could otherwise be obtained is provided for the support of live stock. It has of course chiefly laid the foundation of the late improvements in arable cultivation as well as live stock.

As most of the plants employed in this way are of considerable size and strength, or luxuriance of growth, they must of course, as well as the natural grasses, require the ground on which they are cultivated to possess a good state of fertility, and a considerable fineness of mould, as where this is not the case they seldom succeed in a perfect manner, or afford that abundance of produce which would otherwise be the case. Like the natural grasses, they should also be adapted to the peculiarity of the soil on which they are to be grown, as they are all found to answer better on some kinds of land than others. Some of them succeeding most perfectly on the heavier sorts of soil, as those of the more dry, loamy, clayey, and stronger gravelly descriptions; others on the more strong, poor, and thin kinds of calcareous lands, as those of the chalky and limestone sorts, and others on the deep fertile grounds which abound in vegetable matter.

*Red Clover*\*.—This is a plant which is well known, and that rises to considerable height, with a root that strikes deep into the soil, and rather strong stem, affording a large produce of leaf and blossom, on which account the land is kept in a more perfect state of closeness and shade, while the crop remains upon it, than is the case with most other plants of the artificial grass kind. On this principle it has of course much more influence in ameliorating and

\* *Trifolium pratense.*



improving the soils, and affords a better preparation for wheat crops.

Red clover is capable of being cultivated with success and advantage on almost all the more heavy and dry descriptions of land which are in a tolerable state of fertility, and it is said to succeed on the deeper kinds of gravelly, chalky, and sandy soils.

In respect to preparation it is less nice than many other herbaceous plants, yet the finer the state of mould the land has been brought into, the more certainly and the better it succeeds. And as wheat is the grain crop that mostly follows clover, it may in general be the most advantageous practice to apply manure for the crop with which it is grown, as by that means the ground will be in the most suitable condition for that crop. It may be sown with any clean grain crop, but is found to succeed the best with barley after turnips, where the nature of the soil will admit, as land in that way is brought into the best state of preparation for its reception.

*Seed.*—It is of much consequence in the raising of crops of this sort to sow such seed as is perfectly good, fresh and well ripened; as from its being kept in the shops for a considerable length of time much of it is frequently in a state unfit for vegetating. That which is good has a bright appearance, slides easily in the hand, smells sweet, and has the purple coloured seeds greatly prevailing over those of a yellow cast.

The proportion of seed that is necessary must vary according to the quality of the land, the state of preparation to which it has been reduced, and that of its fertility; as in rich lands almost every seed grows, while in those of the contrary description many of them fail in producing plants, especially in dry seasons, and a great number of the plants are apt to die away after they have come up. It seems not improbable but that both these inconveniencies might in a great measure be removed by having recourse to steeping the seed in some liquid for a short time in such seasons, before it is sown on such sorts of land, as by this means it will be made to vegetate in a more quick, regular, and vigorous manner, without remaining in the soil in an inactive state till it becomes unfit for producing healthy plants.

On the richer sorts of soil that are clean from weeds, ten or twelve pounds may be a sufficient quantity for the acre, while sixteen or eighteen pounds will not be too much for those that are of a more stiff quality, and possess a less degree of fertility. Where the land is to be converted to the purpose of pasturage for two or more years, it may also be advantageous to sow a larger proportion of seed than where it is to be broken up in the following season. And where it is to be cut for hay it is better to be sown rather thin, as the plants will be in less danger of being drawn up weak.

*Time and method of sowing.*—It may be put into the ground in any of the more early spring months with crops of spring corn, or sown over the young wheat crops at the same season. When it is sown with oats, the most common time of putting it in is about the beginning of March; but with barley it is performed at a later period, as in April. It may therefore, perhaps, be more properly sown with this crop than oats in the later districts, where it might be apt



to suffer from the frosts in the preceding months. On the richer soils, as from the luxuriance of its growth too much of it is frequently cut with the barley, so as to keep it in the field so long as to expose it to danger, especially in bad seasons, or from the barley becoming rank and lodging, great injury may be done to the clover, it may be more advisable to sow it with the oat, or over the wheat crops. But on the thinner soils there is seldom any danger is to be apprehended in this way. In order to prevent its proving hurtful to the barley in its early growth, by the rapid progress which it makes in some cases, it has been recommended not to sow it till the barley has sprouted to the height of two or three inches, as it may then be performed to equal advantage as at an earlier period, the barley being rather benefited than injured by the slight harrowing which is necessary. In sowing it among wheat it is the best method, especially in the southern districts, to have the business performed at as early a period in March as the land becomes sufficiently dry to admit of harrowing.

Clover crops may likewise be raised without being mixed with those of the grain kind. In very rich soils this may indeed often be the most advantageous practice, as the danger of either crop being injured by the other will be fully obviated. The sowing in this case should be executed as early in the spring as the state of the land and that of the season will with safety permit.

When clover is sown with grain crops on the more fertile and better prepared lands, with the intention of being kept in the state of pasture for some time, the grain should always be sown much thinner, or in less proportion than is usual under other circumstances, as in this way the danger of its lodging and injuring the clover plant may be avoided. In sowing it with barley it may according to some be put in by the drill-machine, after that crop has been sown, broadcast, being immediately covered by light harrowing. The practice of drilling it in the same drills with the barley, as employed by Duckett, is less common, and by no means so good. In putting clover in with grain crops the most common practice is to perform the business either immediately, or as soon as possible, after the grain has been covered in, as all small seeds vegetate in much the most perfect manner when put in soon after the soil has been turned up, as has been already explained.

In cases where drilling is in use, it is often sown broadcast over the land when the grain is drilled, being covered in after it by a pair of light harrows. It is also sometimes sown before the roller, when the barley has attained a few inches in height. And in the hand or horse-hoeing system, it is frequently sown when such operations are performed.—Mr. Young has likewise known it put in alone upon a scarifying of the barley stubbles in harvest time, on light soils.

With whatever sort of crop the clover seed is sown, it should be dispersed in as regular and even a manner as possible over the surface of the ground when in the broadcast method, after it has been rendered perfectly fine by the harrowing in of the grain crops. And in order that this may be effected in the most complete manner, it should be performed, if possible, when the mould is in such a state of dryness as to work well under the harrow. But it should on no



account be executed when the soil is in such a state of moisture as to clog or stick much together, as under such circumstances the seed will neither vegetate well or be covered in in a regular manner, being liable to be drawn into heaps by harrowing. In covering it in a light short-tined harrow is the most adapted to the purpose, which, in the freer and more mellow sorts of land, should only be passed over once in a place, but in those of the stiffer and more heavy kinds twice may be necessary. The seed should never be buried to much depth, as its vegetation would by that means be much retarded. The use of the tined harrow is much preferable for this purpose to that of the bush kind, as by the latter the seed is not only less perfectly covered in, but liable to be drawn so together as to rise in tufts. But merely rolling over the land, though sometimes employed, is a practice never to be depended upon.

Where the clover is sown among the green wheat, harrowing it in with such light harrows once in a place is the best practice in all cases, except where the wheat is very thin, and the soil too loose about its roots to permit it with safety. In all the more light descriptions of land, the use of the roller after the seed has been covered by the harrow must be of great utility, as well in closing the particles of the soil round the seeds as in levelling the surface, and rendering it less penetrable by drought. And even on strong soils, where the clover is sown among the wheat, it is recommended by some as of great use after harrowing.

With some it is a practice when the land is intended for the purpose of early pasturage, and in some cases where the object is hay, to sow rye, rib, and other similar grasses with the clover. In the first intention the practice may be beneficial, as the rye grass rises early, and may contribute to afford a more full and better herbage for the stock at such periods, especially on the later sorts of soil; but with the latter view it should perhaps seldom be made use of, as the clover will in general produce a sufficiently abundant crop of itself: and from other sorts of plants being mixed with it, on account of their drying in an unequal manner, it may sustain injury as hay. It is probably for some reason of this sort that such clover hay as is mixed with other grasses is less saleable, and of considerably less value in the London markets, than that which consists solely of clover. Some cultivators, however, suppose, that by blending rye grass with clover, in a small proportion, a strength and body is given to the crop. It has been suggested as an improvement where rye grass is mixed with clover, to sow the latter a week or two before the other, as from the clover plants having a tender, weak stem in their early growth, they may in that way be prevented from being injured by those of the rye grass clasping round and shading them.

If the crop be designed for cutting green for the purpose of soiling animals, it would seem to be the best method not to sow any other sort of grass with the clover, as no advantage can be gained in that way.

*After-management.*—Where the seed has been put in on a proper soil in a suitable state of preparation, little attention will be necessary



to the crop afterwards. But as the young plants while in the state of seedling-leaf are liable to be attacked by slugs or other insects, in the manner of turnips, by which the plants are often greatly thinned and destroyed; the crops ought to be carefully attended to in their early growth. Many acres have sometimes been completely ruined in the course of a few nights. Such effects are to be prevented by putting in the crops as soon as possible, that they may become sufficiently strong and vigorous before the dry weather sets in, and by the use of such means as have been advised for turnips.

With some it is the custom to apply manure over the clover crop immediately after the grain has been taken from the land, which in soils that are not in a good state of fertility may be advantageous in preserving and invigorating the plants; but under other circumstances it is not necessary. There is, however, another case in which the use of what is termed long stable dung, when not in the state of fermentation, may be found useful, by preventing the young plants from being too closely nibbled and eaten up by sheep, which is that where the land is in the state of commonage.

But when the clovers are to be continued for two or more years, the application of a thin coat of manure, in the autumn or spring season, is a practice from which great benefit may be derived, especially on lands that are in the less perfect state of heart. In the drier sorts of soil this business may probably be done with the greatest advantage about the latter end of February; but where the lands are soft, retentive of moisture, and poachy, the early part of the autumn, while the ground is sufficiently hard, may be the most suitable season for the purpose. Well-rotted dung is perhaps the most proper in these cases. By performing the work at this period there is less danger of the clover plants dying away in the winter than is the case under other circumstances. At whatever season the manure may be applied, it should be spread out over the surface in as even a manner as possible, and beaten perfectly fine. It is the practice in some places to sow coal ashes over the young clovers, in the latter end of January or the beginning of the following month, when they are intended to be mown in the following summer, in the proportion of about thirty bushels to the acre, by which means the crops are rendered more abundant and the plants better preserved.

The methods of disposing of crops of this sort are either by mowing them for hay, cutting them occasionally as green food for different sorts of live stock, or feeding them down with cattle, sheep, and other animals.

In the first mode a large quantity of hay for the purpose of feeding working horses may be procured with but little expense or trouble. In these cases the crops should be mown as soon as most of the heads are in full blow, before they begin to turn of a brown colour and die away. The most proper time may be known by attending to the foliage on the bottom parts of the plants, as when the leaves on these begin to drop off and decay, the crop should be cut as soon as possible, as by standing afterwards it will lose more in the bottom than it can gain in the top. The crops usually attain this state some time about the middle of June, according to the nature of the soil.



Though it is supposed by some that clover takes less harm by standing, after it is in a condition for being mown, than many other sorts of plants, it is always the best practice to cut it rather early, as by remaining on the ground it not only loses its heads and lower leaves and becomes reduced in quantity, but the plants are rendered hard and sticky and so exhausted as to remain a great length of time after mowing before they send up new shoots and afford good herbage. After it has been cut, Mr. Middleton advises that the swaths should not be spread out, as is the common practice with meadow grass, but suffered to lie in the state the scythe leaves them until they are dried about two-thirds through, which, if the season proves favourable, will be in about three days, and if the weather should then appear promising, they may be turned with rakes immediately after the dew is off. If there be no rain, the clover thus spread out will be ready to cock up the next morning, or on the fourth day, as soon as the dew is fully gone, and may be carried in as soon afterwards as is convenient. And if this be done as soon as the dew is well off, the leaves will be just sufficiently tough to preserve them: whereas when this operation is omitted in the morning, and performed in the heat of the day, they will be too dry, being reduced to powder, and lost in the business of heaping and loading. When, however, it is heaped sufficiently in the morning, the loading and stacking may continue through the day. Where a part of the produce is become rather over dry, there is a method adopted by expert haymakers of putting the rows into heaps without rubbing the leaves off. It is only familiar to a few, and is performed by rolling the swaths over with rather larger forks than usual in a very gentle manner, keeping them from being separated or broken, and then laying them lightly into the cock, being careful to avoid breaking, and tossing the hay about, putting it along the ground, or beating it down flat. In this mode of converting clover into hay, there will not only be much less loss, but the hay be of a much better colour and finer flavour; which are circumstances of great importance both in its sale and use as fodder.

Where a second crop is to be taken for the same purpose, all cattle should be kept out of the field, in order that it may be in full blossom and ready for the scythe about the last week in August. It must be made into hay in the same manner as the first, and should not be delayed later, on account of its losing in weight, and the danger of not getting it into the stack before the heavy dews and rains set in. Besides, by getting the hay off as early as possible, there will be more sheep-feed previous to ploughing the land up in the autumn for wheat. The quantity of produce in the second crop is in general considerably less than in the first, and not by any means so good in quality: consequently, if hay be not much wanted, it is a better practice to feed it, especially where the soil is sufficiently dry, than make it into hay.

The quantity of produce in the first crop varies considerably; showery summers producing great crops, while in dry ones they are often stunted to one half. Besides, the natural quality of the soil has a considerable effect, as well as its being in a high or poor state of cultivation. On the general average of years and soils in Middle-



sex, the two cuttings are said to produce about three loads of marketable hay; which, for the last fifteen or twenty years, are supposed to have yielded twelve guineas per acre. In many cases a much larger profit is afforded. By some, two tons are supposed to be a medium crop for the first cut.

It is mostly employed for the support of draught-horses, as it is the general opinion that it is more nourishing than any other hay, except that of saintfoin. It, of course, sells at about fifteen shillings a ton higher than hay of the meadow kind. It is also found highly useful in fattening oxen and in feeding milch cows; but is less esteemed for saddle-horses, probably from its not having been so much in use, as it would seem well calculated for the purpose.

It is sometimes a profitable practice to let the crop stand for seed. In this case the method is either to eat it well down in the early part of the spring, till about the latter end of May, by ewes and lambs, or other sorts of stock, or to let it stand for a first crop of hay, and depend upon the second crop for seed. The first appears, however, by much the best practice, as the land is less exhausted, consequently in a better state for the succeeding crop; and, at the same time, the farmer has the great advantage of an early green-feed for his stock in the spring months. And it seems not improbable but that seed of a better quality may thus be obtained in a greater abundance, as the plants by being mown must be rendered more weak and less proper for affording good seed; while, by feeding down, they will not only suffer less in this respect, but throw out more flowering-stems, and of course, afford a larger proportion of seed. Where the latter method is followed, the first cut should be made as early as possible. It is always necessary to take off the first growth in one of these ways, as the clover plant does not perfect its seed early in the summer.

The crop thus reserved for seed must be suffered to remain till the husks, or blossoms, become perfectly brown, and the seeds have acquired a considerable degree of firmness. It should then be cut, and harvested in the same method as the common crop, but let remain in the field till it is more perfectly dry and crisp, in order that the seeds may become more fully hardened. It may then be laid up dry, in order to the seed being threshed out in the winter season at the farmer's convenience.

Much labour and expense is necessary in separating the seed from the capsule, slough, or seed-coat, especially when it is effected by threshing, as the work is seldom, from its difficult execution, performed at less than from five to six or seven shillings the bushel. By the use of mills or other contrivances it may, however, be rubbed out with more facility, and at a much cheaper rate.

The produce in seed like that of hay, is liable to vary much, under different circumstances; in general it may be from about three to four or five bushels when perfectly cleaned, weighing from two to three hundred weight. The principal objections to the seeding of clover crops are those of their uncertainty, on account of the state of the season at which they become ripe, the trouble and expense of threshing out the seed, and the injury which they produce in lessening the fertility of the soil. The high value of the seed in most sea-



sons is, however, a great inducement to the letting of clover crops stand for the purpose.

But though much advantage may be derived from the converting of clover crops into hay, and letting them remain for seed, it is probable that a still greater benefit may be produced by the practice of cutting the crops green occasionally, as they attain a sufficient growth, and conveying them when wanted to the horses or other cattle in the stables and fold-yards, in order to their being consumed in the stalls. It is contended by an experienced agricultor, that in this manner it will certainly support more than twice the stock it would do if fed off upon the ground where it grew; and the additional quantity of manure that will by this method be made in the stables and yards, if they are kept well littered with any sort of straw, or even rushes or fern, will fully compensate the farmer for his expense in cutting and bringing the clover into the yards.

The great difference between feeding clovers off on the land and consuming them in their green state in the manner just mentioned, is supposed by an able writer, to be this: “the quick growth of this grass, after mowing, shades the ground, and prevents the sun from exhaling the moisture of the land so much as it would if fed bare; consequently it continues to spring with more vigour; and the moment one crop is off, another begins to shoot up. Whereas when cattle feed it, they frequently destroy almost as much as they eat; and besides, bruise the necks of the roots with their feet, which prevents the clover from springing so freely as it does after a clean cut by the scythe. In hot weather, which is the common season for feeding *clover*, the flies too are generally so troublesome to the cattle, that they are continually running from hedge to hedge to brush them off; by which it is inconceivable what injury they do to the crop. But when they are fed in stables and yards they are more in the shade; they thrive better; and, at the same time, consume the whole of what is given them without waste.”

Much of the success attending this practice without doubt depends on these circumstances; but besides, the upper parts of the roots are less penetrated by moisture, and fewer of the plants of course destroyed. By proper attention to this crop a very useful and abundant green food for different sorts of live stock may be provided at an early period in the spring, especially when the winters are not very severe. It is advised by some, on the poorer sort of soils, to have both the first and second crops of this plant to be eaten green upon the land by sheep and bullocks, being mown and given them to feed upon.

In this way the cattle thrive better from their filling themselves sooner, and having more rest; and there is no waste. But in order to derive the greatest possible advantage from the soiling with this or other crops, convenient covers, sheds, or other suitable houses, are absolutely necessary.

The practice of feeding down or pasturing clover crops with live stock, though it may be advantageous in many cases, especially where sheep-husbandry forms a principal object, always require to be conducted with care and attention, both in respect to the plants and the animals that are to be fed upon them.



From the tender nature of the clover plant it should seldom be eaten on the land by the heavier sorts of cattle, as, from the greedy manner in which they feed, many of the plants are pulled up, and others, as has been seen, greatly injured or destroyed by being bruised in their treading, especially as they protrude their young shoots. Horses are particularly objected to on this account by many. The most appropriate sort of stock is obviously that of sheep; but where the soils are of the drier kind, the lighter sorts of stock of other descriptions may be occasionally admitted, such as calves, foals, and young beasts. And as pigs are fond of the clover plant, and thrive well upon it, they may sometimes be admitted with advantage. In the practice of lamb-suckling it is an useful application of the young clovers to turn the ewes upon them, as they afford a sort of pasturage which has much effect in increasing the flow of milk. They may likewise be applied to the fattening of sheep in April and May; and be fed by the sheep intended for turnips, in the autumn, till they are ready, with much profit. No sort of stock should however be kept upon crops of clover when the land is soft, wet, or poachy. In some of the southern districts, where it is the custom to eat down the young clovers by sheep, it is indeed usual to choose a dry season for the purpose, the stock being removed in case the land becomes soft and wet. Where this sort of stock is employed, it may be the most safe practice not to permit the animals to continue too long upon the land; as by eating the plants too closely they may sustain much mischief.

It would on the whole appear the most beneficial method, where the pasturing of this crop either in the spring or autumn is had recourse to, not to suffer the lands to be fed upon when in a moist state, or to be too hard stocked, or with the heavier sort of animals at any time.

But in the feeding down of clovers, there is not only danger of injuring the plants, but the animals that consume them. Without proper management, cattle and other animals on being turned upon them often suffer great inconvenience, and are in danger of being destroyed by the vast distension of their stomachs which takes place. In this situation the animals are in the language of the farmer said to be *blown or hoven*. The nature of the disease does not seem to be much investigated; but it probably arises in consequence of the large quantity of green succulent herbage being greedily devoured without due mastication, by which it undergoes an uncommon degree of fermentation in the stomach; and from this sudden decomposition, an unusual quantity of gaseous fluid is at once set at liberty, which ultimately overcomes the contractile power of the digestive organ, and the animal is destroyed. The supposition is rendered more probable from the circumstance of the affection being less apt to take place when the clovers or any other similar herbage are fed upon in a dry state, as the stock in these cases are not able to consume them in so expeditious a manner or in so large a proportion.

On these principles, therefore, the practice of not suffering the cattle or other sorts of stock to feed upon them when they are wet, and there is a full bite, would seem to be perfectly correct. The advice of not turning the animals upon the crops before the sun has dissipated the dew and moisture deposited in the night is likewise ju-



icious, and ought to be attended to, as well as that of keeping them in motion as much as possible when first turned in. With sheep the same precautions may be necessary, if they be put upon them with the other stock in their full growth; but when they are turned in after they have in some degree been fed down, there will be little danger of their being injured. Where the clovers are eaten off as after-grass in their soft, foggy, and young state of growth, there is however great danger of the stock being hurt in this way, unless these circumstances be attended to.

Various means of removing the disease, when the animals happen to be affected have been proposed, such as common strong salt and water; and new milk and tar in the proportion of about half an egg-shell full. This last is asserted to afford immediate relief on its reaching the stomach. The stabbing the animal in the flank close to the hip-bone, with a sharp penknife, so as to avoid wounding the intestines, placing a quill in the orifice to discharge the confined air, has likewise been practised with success; but it never should be attempted by unskilful persons. The use of long flexible tubes has also afforded great relief, by being introduced down the gullet into the stomach, and in that way drawing off the distending gas. This method is probably the most safe and effectual, though troublesome in the application.\* There is another remedy which we have found useful in removing this malady in its more early stage, which is that of a very strong solution of prepared *ammonia* in water. By this means the confined air is in some measure discharged from the stomach, and almost immediate relief afforded.

Whatever remedy is employed, it should be applied on the first attack of the disorder, or as soon as the animal is perceived to be uneasy, as there is never any time to be lost, the distension proceeds with such rapidity.

It is evident, from what has been said on this plant, that it must be of vast advantage to have a sufficient extent of it where much stock is to be kept, as it has been found, as pasture, to far exceed most sorts of natural grass in the support of animals.

The chief disadvantage of this almost invaluable plant is that of the shortness of its continuing in the lands, especially those of the lighter and more free kinds. It is asserted by some not to last longer than two years, except on grounds that are perfectly *fresh*; and in some cases where it has been often repeated not more than one. In some of the southern districts, it is, however, found more durable on the calcareous soils, especially when not frequently repeated on the same land, from its being better able to contend with weeds in its natural state of growth. These facts show the necessity of keeping it as far distant as possible in the courses of cropping, especially on all the more light friable sorts of soil, and the superior advantages of cultivating it on those of the calcareous kind.

It is probable that its duration may be considerably prolonged by preventing the plants from shooting up to seed-stems as much as pos-

\* Tubes for this purpose are sold in London.



sible, either by keeping them cut by the scythe, or by feeding them down by stock in a moderate degree; as in these ways they will be prevented from being so soon exhausted in their roots, as happens in many other sorts of plants, as soon as they have perfected their seeds. The frosty nights and hot dry days in the more early spring months, as well as the close sunny weather in the summer season, are highly prejudicial in destroying the clover plant.

When the clovers are kept in the state of herbage more than one year, they are not by any means so proper for sowing wheat after as in other cases: it is the full smothering crops that afford the most suitable preparation for this sort of grain.

Besides the common red or broad clover, there are other kinds used in cultivation; as the *White* or *Dutch* clover, and *Cow Grass*. These, from their being more frequently employed in the laying down of lands for the purpose of permanent grass, have been described above. The first affords a fine delicate herbage, which is very agreeable to most sorts of stock. In the second it is more coarse and abundant but still less so than the common clover; and the plant has the advantage of growing better, and of being more lasting in the poorer sorts of clayey soils.

*Trefoil*.\*—This, as being an useful plant in permanent grass lands, has been already noticed; but its properties as an artificial grass may be described in this place. It is of much less growth than common clover, and much slenderer in the stem; but notwithstanding it is sometimes sown with grain crops in the manner of that crop, the proportion of seed made use of is about three pottles when cleaned from the husks, but in the contrary state two bushels are mostly employed. These may however be varied according to the circumstances of the land.

Some suppose it an advantageous practice, especially where large stocks of cattle are kept, to sow it with oats, or among the wheat crops in the spring when they are to be succeeded by grain in the following season, as by this means good feed is produced in the stubbles for stock in the latter part of the summer and in autumn; and at the same time they are left free for tillage in the spring. The seed is capable of being procured at a cheap rate.

It is said also to afford excellent pasturage for cattle, but to be more particularly calculated for sheep, either when in mixture with clover or alone, as it is not so liable to hurt them by *blowing* or *boiling* as that grass. In the latter case it is of vast importance in the support of sheep, from its being more early than clover, and coming well in after the consumption of the turnip and rye crops before the clovers are ready.

When it is let remain for hay it does not afford a large produce, but a sort which is highly useful as a sheep-fodder in the winter season, and less wasteful than most other kinds, and which, at the same time, is supposed by some less troublesome in the process of hay-making, though others assert that it readily mats together and becomes mouldy by wet.



The seed is to be collected from the second shoot in the manner directed for clover, and the produce is in general considerable, often affording seven or eight bushels of clean seed from the acre. But on the whole it is much less valuable than common clover as an artificial grass.

*Saintfoin.\**—This is a plant which, though less generally introduced into cultivation than clover, is not less important or useful to the farmer. It is on the lighter and thinner sorts of calcareous soils, what that plant is on all those of the strong, heavy, and more deep kind; and it has the superiority of being more durable. It is equally advantageous for the purposes of hay as those of pasturage, and in the latter method has not, it is said, the dangerous property of *bowing* or *swelling* the cattle that feed upon it, as is the case with clover. Its lasting properties on poor barren soils in hilly situations, where other sorts of grassy herbage are deficient or scarcely to be procured at all, likewise render it particularly beneficial in supplying a valuable green food for different sorts of stock.

The soils most proper for this sort of grass are those of chalky loams, light sandy or gravelly kind, or almost any of a mixed quality, provided they be not wet, and have a rocky or hard calcareous bottom, to check the roots at the depth of a foot or fifteen inches below the surface; otherwise they are apt to exhaust themselves in running down. On this account it is improper for being sown where there is great depth of mould. It is asserted to afford a large produce even on those of the poorest quality; and on such as are of a more rich and friable nature it is often very abundant. It is only, however, in the calcareous soils, or such as have been well impregnated with that sort of matter, that this plant succeeds in a perfect manner, or becomes durable.

In regard to the preparation of the ground, it cannot be made too clean or too fine before the seed is sown; of course it generally succeeds best after turnips or other similar crops which require a fine clean culture while they are growing. It often, however, answers well on lands that have not undergone so high a degree of preparation.

*Seed.*—This should be selected from the best plants, and those which are most suited to the soil of the cultivator by their durable properties. It should always be sown fresh, as that which is old never vegetates well. The proportion of seed which is necessary must be different according to the circumstances of the land; but in the broadcast method about four bushels are probably in general the most proper quantity, as on these sorts of soil it is better to have the plants thick; some, however, think less than half the above proportion sufficient. In the drill mode three bushels are mostly employed. Seed of this sort is usually procured at from about three to five or six shillings a bushel.

*Time and Method of Sowing.*—The earlier the seeds of this grass can be put into the ground in the spring the better, as there will be the more chance of their vegetating in a perfect manner from the

\* *Hedysarum onobrychis*.



greater proportion of moisture in the soil, as when the business is performed at a late period, if a dry season follow, much of the seed would be prevented from growing, and the young plants that come up be more exposed to the attacks of the fly. The latter end of February or the beginning of the following month may answer very well in most cases. It is, however, by some cultivators sown in the autumn with the wheat crop; but the practice is not to be recommended, as there may be danger of its not growing well, or of being injured in the winter season.

It may be put in either alone or with any of the spring corn crops, but with barley after turnips is considered the best method. Some advise its being sown with about half the quantity of barley which is usually sown for a full crop, as it may shade and keep it moist during the first summer; and at the same time not injure it from the crop being lighter, which is sometimes the case. Where the barley is drilled, the saintfoin may afterwards be put in, in the same manner, but in a contrary direction, as is sometimes the case in Norfolk. If sown over the wheats it should be harrowed in, and afterwards rolled. In whatever method it is sown, as the seeds are larger than those of many other grasses, they should be covered in with more care and to a somewhat greater depth. Some advise the ploughing the seed in with a very thin or shallow furrow. In most cases, especially in all the more light sorts of land on which this crop is sown, the use of the roller may likewise be necessary.

It is sometimes a practice to sow a small portion of clover seed with this crop, with the idea of increasing the first year's produce; but as plants of different kinds seldom succeed well together, from there being a continual contest in their growth for an ascendancy, it is probably a better practice to increase the proportion of the seed without mixing it with that of other sorts. Mr. Marshall, however, seems to think the method beneficial in ultimately procuring a fine clean crop of saintfoin.

*After-management.*—On this being properly attended to, a great deal of the success in the culture of this plant depends. The most experienced cultivators of the grass advise its being cut for hay instead of being pastured. But others think it more advantageous neither to cut nor pasture it in the autumn of the first year. It is probable that both practices may be proper under different circumstances; as in the richer sorts of soil, where this plant mostly affords a tolerable crop when sown alone the first year, it may be mown with propriety and without much injury being done to the plants; but in those of the thinner and more poor kinds, where the crops are in general the first season but thin on the ground and light, it may be advantageous to let them remain without being cut or fed down by stock, as in this way they may spread more, and form a better and more close sward in the following year. By the plants in this case being suffered to seed, besides the advantage just mentioned, they will have acquired a great vigour of growth, and the succeeding crops be greatly increased from the shedding of the seeds.

In all cases, in the succeeding summers, a crop of hay may be



taken, and the after-grass be fed down with any sorts of stock but sheep till towards December, care being taken that they do not eat it in too close a manner, as where that is the case, from the largeness of the roots, they may be in danger of injuring the crowns of the plants. In the following autumns there will, however, be less risk in this respect, and sheep, as well as cattle stock, may be turned in and kept upon the pastures till they are all well eaten down, being always careful to shut them up as early as possible in the beginning of the year.

The quantity of produce must of course be liable to vary much according to the nature of the soil, and the care that has been bestowed in the preparation: on a medium of soil and culture it may probably be estimated at about two tons. The poorer and thinner stapled sorts of land, worth little more than five shillings an acre, will seldom afford less than from a ton to a ton and a half.

On the thinner sorts of soil it cannot seldom be cut more than once, but on those of the deeper kinds two crops are sometimes taken in the same way as with clover.

In its green state it is highly useful for all sorts of stock: though some suppose, that when given to milch cows the milk is not so well flavoured.

When made into hay it is an extremely nutritious fodder for working-horses, as well as other sorts of cattle. And the after-grass is highly valuable for weaning and supporting lambs.

As this sort of herbage is supposed to be improved by being nipped by the frost, it may be a proper practice not to turn upon these lays too early in the autumn.

The application of manure upon saintfoin lays is of great utility, when put on in the latter end of the second autumn after they have been laid down. For this purpose peat ashes are the best material where they can be procured. Other sorts of ashes are likewise found beneficial where these cannot be had. They should be applied so as to form a thin even dressing. Soot has also been found of great utility when spread evenly over these lays about the beginning of January, in the proportion of about twenty-five bushels to the acre. And malt dust has been employed in the same way with great success. Where top-dressings of this sort can be applied every third or fourth year, the saintfoin crops, when well established in the soils, may be preserved in a state of vigorous growth for ten or fifteen years, and the land be considerably improved by the roots. It usually attains its perfect growth about the third year; and begins to decline towards the eighth or tenth, if not well assisted by manure in the manner mentioned above.

It is, in some cases, a profitable application of this sort of crop to cut it before it comes into flower, for the purpose of soiling horned and other sorts of cattle, in the manner that has been described for clover.

The most usual application of it is, however, in hay, which it affords of the best and most nutritious quality, both for horses and other sorts of cattle. The method of bringing it into this condition differs but little from that employed for clover. It is cut im-



diately on its coming into full blossom; and as it remains but a short time in this state, as much expedition as possible is employed both in mowing and making the produce into hay. This, of all other grasses, requires the least pains in making. When the season is fine the hay-makers may follow the scythe, and having turned over the swaths, throw them into wind-rows the succeeding day after the grass is mown, when it may be immediately formed into cocks, and the whole crop be fit for carting in a few days after it is mown: and though it may appear very green, and the stack when made take on a considerable degree of heat, there is no danger to be apprehended, provided the weather has been fair during the hay-making; as it is so far from taking harm by heating in the stack, that the contrary state is most to be feared; and for this reason care is necessary not to suffer the fodder to continue long either in the swath or in grass cocks, lest the sun and wind should dry it up too fast, and, by exhaling its juices, prevent its heating in the stack, and thereby render it of little value. In order to preserve its succulence, in some places they put a number of the grass cocks together, so as to form large cocks of a size to contain a load in each, and finish the stacks out of the cocks. It is likewise the practice with many farmers, when the crop is slight, to turn the swaths, and then run them into cocks with a three-pronged barley fork, following with a wooden dew rake, the head of which is of sufficient width to cover the ground occupied by three or four swaths; in this manner proceeding with the utmost dispatch, saving a deal of labour and expense.

In letting this crop stand for seed, it should remain on the land till the husks become of a somewhat brown colour, and the seeds are perfectly plump and firm, as by these means they will not only be better, but in less danger of being injured in the field from the little time that it will be necessary for them to remain, and also less in danger of being hurt by heating when laid up. After this degree of maturity is attained, the crop should be mown as soon as possible, and remain exposed in the swath till the upper surface is fully dried: it must then be turned over in a very careful manner, so as to prevent the seed from shedding, as much as the nature of the business will admit. This side being rendered perfectly dry and crisp in the same way, the crop is either threshed out upon cloaths in the field, or laid up in stacks to be afterwards performed. The business of threshing out the seed in this crop, however, is much less troublesome than in that of clover. Where threshing machines are in use, it may be threshed out with great facility in that method. When the season is favourable the practice of threshing it out in the first way is probably the most beneficial, as the stems, or haulm, may be laid up for the purpose of fodder in the stack.

The produce in seed is usually from about four to five coombs in some districts; but in others it will probably be much less, especially on the shallower sorts of saintfoin soils.

It is evident, from the facts that have been stated, that this is a plant of vast utility to the farmer, not only in providing a full supply of fodder for the support of stock, but of good green feed



for the latter part of autumn, in soils that are adapted to its culture, as it is capable of affording a large produce, even on those thin poor descriptions of land that under other circumstances yield only a very scanty product either in herbage or hay. And in such as are of the better and more fertile kinds the quantity of crop is incomparably abundant. Its culture ought, therefore, to be extended to all those extensive tracts of land in different parts of the kingdom that afford little or nothing under other systems of husbandry or modes of cropping, and which are not adapted to the growth of clovers.—This is particularly desirable, as it is an artificial grass that succeeds well in the ordinary methods of sowing, without the trouble or expense of either the drill or the hoe. It seems extremely probable, from different trials that have been made with this plant, that it is not by any means so confined in respect to soil as has been generally supposed, though there can be little doubt but that it answers best on those of the calcareous dry loamy kinds. On such as have had occasionally applications of lime it has been known to succeed in a perfect manner.

The situations that are the most unfriendly to the growth of this grass are those where there is much stagnant moisture in the soils, or where they are wet and spongy; a considerable degree of dryness being essential to the healthy vegetation of the saintfoin plant.

The principal inconvenience which crops of this sort sustain is from the rising of coarse grasses, and weeds of different kinds, as it is these that, in a great measure, limit the duration of the plants, and not that of their age: the advantage of a proper and clean preparation of the land previous to its being sown is therefore sufficiently evident. Where, notwithstanding every precaution, such grasses come up so as to injure the saintfoin, harrowing has been had recourse to with success, when performed to such a degree as to leave the surface of the land in nearly the state of fallow.

*Lucern* \*.—This is another plant of the artificial grass kind, that may in some cases be cultivated with much profit and advantage, as affording a large produce of succulent green food, for the support of different sorts of stock, and likewise of hay for the winter fodder of horses or other cattle.

The soils most suitable to the culture of this plant are all those of the more deep, rich, and drier kinds, as those of the sound, mellow, loamy, gravelly and sandy descriptions; but on such as are retentive of moisture it should not be attempted, as the roots are liable to be greatly injured, if not wholly destroyed, by the stagnation of water about them. Weeping gravelly lands, and all such as are not well drained, are of course improper for this sort of culture. It is supposed by some, that for the successful cultivation of this sort of crop, it is necessary that there should be a sub-stratum of such a sort as is capable of stopping the descent of the roots at a certain depth, in order to prevent their exhausting themselves; but the depth of the mould, in this case, should be considerably greater than for that

\* *Medicago sativa*.



of the preceding grass, a foot and a half to two feet being mostly requisite.

In the preparation of the land the soil should always be brought into as fine a condition of mould as possible. This may be effected by repeated ploughing and harrowing, and the previous growth of such crops of the green kind as have a tendency to clean and render the land more fine and mellow. In this intention, some advise the taking of two crops of turnips, carrots, or cabbages, either in succession or alternating with each other; the turnips, in the heavier loams, being eaten off upon the land in the second autumn, before it is ploughed up. In either of these cases, from the hoeing and constant culture which is necessary, while the crops are upon the land, it will be left in a suitable state of cleanness and friability. Others recommend fallowing as a better practice, the root weeds of every kind being carefully pricked out in the different ploughings and harrowings. From the great length of time that the ground must remain unemployed in this mode of preparation, it is probably, however, only capable of being practised with advantage where the lands are heavy and very full of weeds. Before the seed is put in, the soil must be rendered perfectly fine by ploughing it over as frequently as may be necessary, and breaking it well down by occasionally harrowing. It will seldom be necessary to make use of manure; but where the land is found to stand in need of it, application is best made with the first of the green crops. The object to be constantly kept in view in this business is chiefly that of rendering the land perfectly clean from weeds, and at the same time highly mellow and friable.

*Seed* —The seed of lucern is larger and of a more pale colour than that of clover; and as much of it is brought annually from Holland, it is commonly purchased in the seed shops, the price varying from one to two shillings a pound. As seedsmen are apt to keep their seeds from year to year, it may be necessary to observe, that that which is perfectly fresh is the most proper for being sown, as small seeds in general vegetate in the most perfect manner when new. The proportion of seed that is necessary is variable, according to the nature of the land and the manner in which the crop is cultivated. In the broadcast method, which has been found very successful, from eighteen to twenty pounds may be proper, while in that of the drill it will be considerably less, according to the distances at which the operation is performed. In two feet equidistant rows the usual allowance is about six pounds; in those of eighteen inches, about eight pounds; in those of twelve inches, ten or twelve pounds; and in nine inch rows, which are by much the best, from twelve to sixteen pounds may be necessary.

*Time and Method of Sowing* —The most proper season for putting this sort of crop into the ground is as early as can be done in the spring months, as in this way plants may be fully established before the season becomes too hot. The latter end of March for the more southern districts may be the most proper period, and the beginning of the following month for those of the north. When sown late there is more danger of the plants being destroyed by the fly, as has been observed by Mr. Tull. If the plants be intended to be trans-



planted out in the garden method, it will also be the best practice to sow the seed bed as early in the spring as the frosts will admit, in order that they may be strong and fit to set out about August.

With regard to the mode of putting in the crop, it should vary with the circumstances of the soil, and the mode of after-management that can be adopted with the most convenience. Where much attention cannot be bestowed in the business of hoeing and keeping the crop clean, the best method is that of sowing the land broadcast; though in this method the crop may not last so long in the ground. But in cases where the crops are capable of being kept in a sufficiently clean condition by repeated hoe culture, the drill may be more advisable, especially at narrow distances. Some, however, think it the best method in all cases.

The practice of transplanting can, perhaps, only be done in particular cases, on small pieces of deep land that are in great heart, and require the plants in consequence to stand thin and regular upon the ground, as in this mode they become large and of vigorous growth. In soils that are inclined to moisture at some depth below the surface, it may be an useful method of keeping the roots of the plants from being injured by their penetrating too deeply, as is more the case when the plants rise from seed.

The seed may be sown either alone or with grain crops, in the same manner as clover: each method has its advocates, and it is probable that they may both be useful under different circumstances, as in the deeper and more fertile sorts of lands the first may be the most beneficial method, and in those of the lighter and less deep kinds the latter;—as in the deep, rich sorts of land there may be less loss of time in procuring the green produce for the use of horses or other sorts of stock, as well as the greater certainty of the crop succeeding. But in the lighter and more porous soils, by being sown with corn, the plants may be better protected in their early growth, as well by the shade as the moisture that will in that way be preserved. Some indeed speak of its superior utility, on the ground of long experience, in its being better preserved from the fly. Wherever this mode is made use of, the grain should however be sown thinner than is usually the case in proportion as the soils are more rich. Oats are preferable to barley for the purpose, as being less liable to lodge, especially when sown thin. From five or six pecks to three bushels, sown as evenly as possible, may be the best proportions, the smallest quantity being necessary on the richest soils.

After the grain has been sown and harrowed properly in, the lucern seed should be immediately sown by a regular even cast over the fine surface, covering it in with a light seed harrow; but it should not be too deeply covered in, two inches is fully sufficient. In the drill method the same system should be followed, the lucern seed being drilled in, either lengthways or across, at suitable distances, immediately after the corn has been put in.

In regard to the proper distance of the rows where the drill mode of culture is practised, it should probably depend upon the state and circumstances of the soils; some advise two feet as the best distance in all cases while others think equal distances of a foot in rich soils,



such has are worth from thirty to forty shillings the acre, and nine inches those that are of inferior fertility, as from fifteen to twenty shillings the acre, the best general distances. On soils of less value, it is probable that this culture can seldom be had recourse to with much benefit to the farmer. The last distance approaches much to the broadcast method, which is contended by some as the most appropriate in all cases; of course it may be preferable, as it admits of being ploughed between by a suitable plough in the room of the harrow.

The seed, in whatever method it may have been sown, is, when good, rather rapid in its vegetation, beginning to sprout in the course of a week, and soon spreading itself over the surface of the land. And the sooner it attains its rough leaf the better, as it is then, like turnips, out of danger of being destroyed by the fly. Before these plants arrive at this state of growth, they are liable, especially in dry seasons, to be much injured, if not wholly consumed, by the ravages of the same sort of insect as that which is so detrimental to the turnip plant. Where the greatest part of the plants are injured in this way, it is probably the best method, when the crop has been put in alone, to plough up the land, and sow it down again with fresh seed as soon as possible. This is an advantage which the practice of sowing the crop alone has over that of putting it in with those of other kinds:

*After-management.*—As the economy of this plant is such as to render it incapable of being grown with much advantage where other sorts of plants, whether of the grass or weed kind, are apt to annoy it, much care and attention should of course be employed in keeping it clean and free from the intrusion of all such vegetable productions. This may be effected in different ways according to the methods in which the crop has been raised. Where the broadcast plan has been pursued, little is necessary where the land has been properly prepared, after the grain crop has been removed, except keeping all sorts of heavy stock from coming upon it. In a dry season, if there be occasion, the field may, however be fed a little by calves and other very light stock, but they should never be kept long upon the plants at one time. When the second cutting has been made in the following year, if any grass shows itself, the land should be harrowed over in a moderate manner by a harrow which is not too heavy or too long in the tines, twice or oftener, as may be necessary, in different directions, the grassy matter being collected by a small light implement of the same kind, and removed from the land. This business should be executed as soon in the early part of the spring as the nature and state of the ground will admit, as dry a period as possible being taken for performing the work. In the succeeding years two such harrowings may frequently be required, one in the early part of the spring season and the other in the close of the summer. But in these cases, especially where there is much grass appearing, a much heavier sort of harrow should be made use of. Some advise one of such weight as is sufficient for four horses, and which does not spread more than four or five feet; but in most cases, especially when the business is so frequently done, one that requires less draught may be



adequate to the purpose, as where such large heavy harrows are employed, there is much danger of injuring the crowns of the plants, and thereby causing their destruction: whereas by the use of lighter ones they are mostly much benefited from the mould being stirred about their roots. After these harrowings, as in the above case, the weeds should be brought together and removed from the ground. Where the crops are thin and patchy, seed in proportion to the deficiencies should be sown over such places before the harrowings commence each time. In every case the rollers should be applied immediately after the operation has been performed, not only for the purpose of pressing the mould about the roots of the plant, but to render the surface perfectly level and fit for the scythe,

In the broadcast method of culture, where the produce is not to a considerable extent, it is probably better to feed the crop by light cattle stock in the autumn than mow it.

In the drill-sown lucern some recommend, where the rows are sufficiently evident in the autumn season, after the grain has been secured, the passing of a small shim between them, in order to extirpate all the weeds and grassy materials, as well as to loosen the mould about the roots of the plants, and, that they may be rendered more perfectly clean, the hand-hoeing of the plants in the rows. In the succeeding year still more particular attention to the use of the shim and hoe will be requisite. The business should be begun as early as the state of the soils will safely admit of its being executed; being continued occasionally in such manner during the whole summer, as is sufficient for preserving the crops perfectly clean and free from all sorts of weeds. But in order to accomplish this in the most complete way, great circumspection is necessary, immediately after the lucern has been cut, to the extirpation of the natural grass plants and the weeds of other kinds, as at this period they can be discovered and removed with the greatest facility and dispatch.

The crops raised in the transplanted method, as they are put in so late in the summer season, will demand but little regard in the autumn: one or at most two slight hoeings may be sufficient for the purpose. But in the following year's culture the same management will be proper as in the preceding case.

When the soils on which the plant is grown are not of considerable fertility, the occasional application of manure may be of great advantage in thickening and increasing the quantity of crop. For this use clean well rotted dung is probably by much the best manure, as where earthy composts, ashes, or soot are employed, they are apt to promote the growth of, or bring up common grasses too much. The latter are, however, sometimes sown over the crops in the winter season. The dung is advised by some to be applied in the quantity of about twenty tons to the acre every five or six years. Others, however, think it a better practice to put a light coat on annually in the early spring season.

The culture of this sort of crop is obviously attended with considerable expense, both in its first establishment and the after-management which is necessary to ensure its success. The inexperienced cultivator should not therefore commence this kind of husbandry



too hastily, without considering how far it may suit his circumstances.

As this is one of the most forward of the artificial grasses, it frequently attains a sufficient growth for the scythe towards the end of May or beginning of the following month, and in soils that are favourable for its culture will be in a state of readiness for a second cutting in the course of a month or six weeks longer; being capable of undergoing the same operation at nearly similar distances of time during the whole of the summer season.

The produce of this sort of crop in converting it to the purposes of soiling cattle must necessarily be different under different circumstances; but an acre can seldom when under proper culture and management, support less than from three to five or six horses or other cattle during the six summer months; the profit of which cannot be less than from seven to ten or twelve pounds.

And in letting it remain for hay, which is less advantageous, in the three mowings an acre where the crop is good will seldom afford less than from three to five tons of dry hay. In Mr. Arbuthnot's trials, the produce was four loads, but in those of others on rich grounds it was five. In making this sort of plant into hay the same directions should be attended to as for clover; the less the produce is shaken about, the better, provided it be sufficiently quickly dried; as the leaves will be more fully preserved on the stems, and the hay of course more valuable.

In the application of the crop the principal and obviously the most advantageous practice is that of soiling horses, neat cattle, and hogs. But as a dry fodder it is also capable of affording much assistance in many cases. And as an early food for ewes and lambs, it may be of great value in particular cases. As this plant bears repeated cutting better than most of those of the artificial grass kind, springs in a more quick and expeditious manner, and affords a healthy nutritious food, in soiling it must be of vast utility to the farmer where horses and cattle form a large part of his stock.

In the soiling of cows and other sorts of cattle in the fold-yards, and in the feeding and fattening of oxen, its importance is equally great. In feeding cattle with this sort of food in its green state, care is necessary, however, not to give the animals too largely at a time, especially when it is moist, as they may be *hoven* or *blown* with it in the same way as with clover.

The trials in fattening bullocks, or other cattle with this green fodder are not numerous; but they are sufficiently so to prove its utility in such application. In Mr. Young's trials, cattle were found to increase fast in flesh by it, paying at the rate of four shillings and six-pence a head per week, which is considered as a great proof of the value of the plant: in this view its superiority to tares he thinks prodigious. It has also been considered of great value in this view in Ireland, by Mr. Herbert, after much experience. The great power which it possesses in fattening is, indeed, rendered sufficiently evident, by the sudden effects which it produces in soiling horses. In most instances they get into high condi-



tion in a short time, becoming "fat without oats or hay" in some cases.

Sheep have likewise been fattened on this green food with great success in Mr. Baldwin's trials.

In soiling hogs in the fold-yards it has also been attended with considerable success. And it has been suggested, that as these animals do not bite so closely as sheep, they may be admitted upon the crops with greater safety. A plot of it contiguous to the yards might in this view be highly beneficial.

It is sufficiently clear, from these statements, that soiling is a highly beneficial method of disposing of lucern crops, and far superior to making it into hay.

Though crops of this sort should not, by any means, be fed close with sheep stock, it is probable that, in particular cases, they may be applied as an earlier green feed for ewes and lambs with great utility and convenience, as they may be relied on for this sort of feed much sooner than any other kinds of artificial grass crops, especially in soils of the rich, dry, and warm descriptions: being often ready for the purpose soon after the middle of March, affording a good bite through the whole of the following month, the most difficult period for the providing of suitable support for this kind of stock. The benefit produced in the healthy growth and improvement of the lambs in this mode, will much more than counterbalance any loss sustained in the first cuts for soiling of horses. The sheep should not, however, remain on longer than while the first shoots are eaten down.

On the whole, though this plant is capable of being thus usefully applied, considering the very great expenses which are necessary in raising and keeping lucern crops in a state of production, and their affording but little produce, especially when sown without corn, for the first years, notwithstanding they appear to yield a great advantage in the practice of soiling animals, it is probable that much of the profit depends upon the method of consuming them, and not on that of the particularly advantageous nature of the plants. Its superiority to clover, when the differences in the expenses of their culture and other circumstances are fairly brought into view, will not, perhaps, appear so great as many on a superficial observation may have supposed. The point in which it most materially excels that invaluable plant is the duration, or time which it lasts in the ground, after being once introduced, continuing from ten to fifteen and even twenty years, according to the state and nature of the soil, and the attention that is bestowed in the after-management. This is, undoubtedly, a circumstance of the first importance, in cases where the cultivator wishes to avoid the trouble and expense of grain crops, as he can keep a suitable extent of land under this crop for the purpose of soiling his stock without them, while with clover it is utterly impossible. Where the proportion of land is small, and the quantity of cattle and horse stock disproportionately large, it is a plant admirably calculated for the cultivator's purpose, when grown conveniently to the farm yards and kept in due order by proper cultivation. It has also been recommended on dairy farms



as of great utility in supporting the cows and increasing the quantity of milk. Where the soils are suitable a few acres under this grass round the house must in almost all cases be valuable for the purpose of early green food.

On attempting to break up lands that have been long under this sort of crop, it has been sometimes found from the great strength of the roots of the lucern plants, and the consequent difficulty of destroying them, that the crops have been restored in such a manner as to induce the cultivators to leave it again for the production of this grass. In situations where such grounds could be conveniently flooded, or covered with water occasionally, they might, therefore, be very advantageously converted into good meadow or grass lands; a sort of application that has long since been recommended by a French writer.

When such lands are perfectly broken up, they afford, in most cases, admirable crops of the grain kind. Oats, as being the least injured by a luxuriant growth, may in general be the most advisable as the first crop.

The nature, cultivation, and modes of applying different sorts of artificial grasses in the feeding of live stock being explained, we shall consider a few other plants of the herbaceous kind, which seem properly to belong to this place, from their great importance and use in affording plentiful supplies of green food for the support of cattle or other sorts of live stock.

*Tares* \*.—This is a plant which, from its tall, close, hardy growth and succulent nature, is capable of being introduced with vast advantage in the manner of those of the artificial grass kind, between different sorts of grain crops, with the view of preventing the fertility of the land from being too much expended, and at the same time procuring an useful supply of green or other fodder for the consumption of horses or other descriptions of stock. It has indeed been contended by an intelligent cultivator, that it, “may be made the means of enabling the arable farmer to support as much live stock as the grazier,” as while crops of this sort remain upon the ground they afford larger supplies of the best kind of green food on the acre, than the most rich and fertile grass lands; and they may be taken from the ground at so early a period in the summer season as, on the friable loamy soils, to admit of a clean crop of turnips being obtained from the same land in the same year, and of those of the more heavy kinds being sown with wheat. And while they are capable of being raised with success on most kinds of soils and situations, they support and fatten cattle and sheep of different sizes and breeds in an expeditious manner. Besides, they afford a good preparation for other sorts of green crops, and in that way keep up the successions of such kinds of food for the fattening of additional quantities of animals; and in that way produce abundance of manure in situations where it could not otherwise be procured. In short, he supposes that by a judicious combination of this plant with those of turnips, clover and saintfoin, the poor

\* *Vicia sativa*.



downs, sheep-walks, and other waste lands, may be rendered from ten to thirty times more valuable than they are at present.

But, however sanguine these observations may be, there cannot be any doubt but that the tare may be an useful object of cultivation in the view of improving the land, as well as the supporting of a larger stock, and a plant that ought to be more generally grown in most situations, in proportion to the extent of the stock that is kept.

The common tare is distinguished by writers on husbandry into two sorts,—the *winter* and *spring* tare: the latter is probably a variety of the above species. It is, however, much less hardy in its habits than that of the former or spring kind; the plants when wholly of this sort being capable of resisting the effects of the severest winter seasons in this climate.

In cultivating these plants, with a view to ascertain their difference in respect to hardness, the Rev. Mr. Laurents, of Bury in Suffolk, is stated by Mr. Young to have made the following experiments:—On the 30th of September 1783 he sowed seeds of the winter tare and of the spring tare near to one another, in the same soil and exposure, and covered both with a coat of crumbled mould one inch deep. The weather proving mild, the spring tare soon made its appearance; and two days afterwards the winter tare came up. This ascendancy the former did not fail to maintain over the latter until the middle of December; at which time that was about six inches high, and this not above four. They were both in a vigorous and thriving condition when a frost came on and continued for some weeks. On a thaw taking place, he found the spring tare lying on the ground, slimy, and putrified to the very root. The winter tare had received no damage. It grew up afterwards, and was ripe before the middle of August.

This difference in the effects the frost had on them, led him to view the state of tares in more open situations; where he found that in some grounds scarce any plants had been destroyed, in others patches of something in a state of putrefaction, resembling the dead tares in his garden, were observed.

And on the 6th of March 1784, both sorts were again sown in the manner described above; and in their springing up and growth, a progress similar to that which he had remarked in autumn was observed. Near a week later than the winter tare of the autumnal sowing, the spring tare of the vernal sowing arrived to perfect maturity. But the winter tare of the vernal sowing was mildewed, not a single pod of it ripening.

From these two circumstances there appears a material difference in the constitution, if he may so call it, of the two sorts of tares in question. He adduces nothing as to the trifling difference in the colour and size of their seeds, but passes on to the only visible marks of distinction he was able to trace in watching the process of the two experiments. And this is a disparity in the first leaves of the upper part of the stalks of the plants when gathered about the end of November, while the leaves on the branches, which afterwards issue in the lower part, and in time form the bulk of the plants, resemble one another in the two vetches. This is all he has been



able to offer towards the decision of this point. These differences may be seen by consulting a plate in the second volume of the *Annals of Agriculture*.

It has been observed by the author of the *Synopsis of Husbandry*, that “the seeds of the winter and spring tare are not easily discriminated, being nearly alike in size and every other characteristic: but on the appearance of the blade the difference is at once to be perceived. The winter tare vegetates with a seed leaf of a fresh green colour, whereas the spring tare comes up with a grassy spear of a brown dusky hue.”

There is likewise a second variety which is denominated the *white* tare, but it is tenderer than even the spring tare, of course seldom employed in field culture.

The tare is a plant which in respect to soil admits of considerable latitude, growing without difficulty on all the varieties, from the thin gravelly to those of the deep and stiff clayey kinds, but flourishes in the most vigorous manner on those gravelly loams that are not too moist.

In the preparation of the land for this crop less care is necessary than for many other sorts of grass crops, as it will succeed well where the soil has not been much broken down or reduced into fine mould; but it always grows in the most perfect and vigorous manner where a degree of fineness has been produced in the land. Two ploughings, with occasional harrowings in the intermediate times, may in general be sufficient for the purpose at whatever season the crop is put in. They are sometimes sown on one ploughing, especially the winter crops; but the practice is not to be recommended, especially on the stronger sorts of soils. In such soils as are not rich it is a good practice to manure for this crop.

*Seed.*—As the seed of the spring tare does not succeed well when sown for the winter crop, nor that of the winter kind when put in for the summer produce, care should be taken to keep the seed of the two sorts as perfectly distinct as possible. And as they are, from their being both of nearly the same colour and size as well as their agreeing in other particulars, liable to be mixed in the seed-shops, it may be the best practice for the cultivator to preserve his own seed, as by that means he may not only be certain of having the seed good in its quality, but of the right sort, and of course may depend more fully on his crops.

It has been suggested that steeping the seed in dry seasons may be of utility in promoting the quick vegetation of the crop.

The quantity of seed should vary according to the nature of the soil and the method of sowing. From two bushels to two and a half are the proportions recommended by some in the broadcast method. Others advise three bushels; but on medium soils in the middle of the season the former may be fully sufficient. Where the land is more rich and the seed put in early, less may answer the purpose; but on poor sorts of land, where the seed is sown late and the climate is backward, the latter quantity may not be too much. In the drill mode, at six inches, two bushels are enough. When the crops are either to be cut for soiling or to be fed down, the pro-



portion of seed should be increased, as not only a greater produce is thereby provided, but the growth of the crops rendered more quick.

*Time and Method of Sowing.*—The periods of sowing tare crops vary with the intentions of the cultivator, but the winter sowings should be performed some time between August and October: in late exposed situations and poor soils more early than in those of the contrary. In the former the beginning of August may not be too early. In other cases the latter end of that month or the beginning of the following may be better. It should, however, for the general crop always be done in such time as that the plants may be perfectly established in the soil before the cold season begins, as by this means the crops succeed better. For the spring sowings, from the latter end of February to the end of March or beginning of April may answer very well; but the sooner the better, as the plants will have got the more firm hold of the ground before the hot season sets in. Mr. Young also considers it good husbandry to sow spring tares in June with a quart of cole seed per acre over the same land, in order that a good nutritious feed may be provided for weaned lambs in the autumn. This is practised in Sussex on the down lands with success. It is of great advantage in providing a due succession of green food for the spring consumption to sow at different periods in the autumn.

The method of sowing is mostly that of the broadcast, which should be performed as evenly as possible over the surface, the seed being afterwards well covered by harrowing, in order to prevent their being picked up by birds, and ensure their perfect vegetation. In rich clean soils it is probable, however, that the row method would succeed well at six or eight inches with this sort of crop, as is the case in some of the southern districts.

Crops of this sort are mostly cultivated after wheat or barley; but they may be grown after almost any kind where the land is in good heart.

*After-management.*—As this sort of crop covers the land in a very complete manner where it is sufficiently full, it does not require so much attention during its growth as many others. Some nice cultivators, however, make a point of hoeing up and drawing out all the more coarse and rank kinds of weeds that are in danger of doing injury to the tare plants, and which they cannot smother and overpower. This business should be performed as early in the spring as possible. And in order that the land may be in better order for the scythe, a light roller may be passed over the crops, when the season is tolerably dry, in the very early spring months.

When the parts of crops of this sort that have run to seed, or any others, are left for the purpose of a supply, it is the usual practice to cut and *swad* them in the same manner as for peas, in order to their being afterwards housed or stacked, and threshed out in the winter season.

In making tares into hay, more attention is necessary than in those of most of the artificial grasses, as wet is more injurious to them, and they require more sun and air: but in other respects



they demand the same cautious management in order to preserve the foliage from being lost. The time for cutting for this purpose is when the blossoms have declined, and they begin to fall flat. When well made the hay is of the most nutritious quality. The produce in tare crops, as in those of other sorts, must be different according to circumstances; but when they are good, in the winter kinds it is commonly considerable. The writer of the Report of the State of Agriculture in Middlesex states it as the result of experience, having frequently weighed green tares, to be twelve tons per acre; and when made into hay, at about three tons;—the value of the produce, estimating it as if the whole were made into hay, being in that district from twelve to fifteen guineas the acre, and in places where other sorts of hay sell at fifty shillings or three pounds, at from seven pounds ten shillings to nine pounds. The spring tare crops are in general lighter, and more liable to be injured by a dry season than the winter.

The produce in seed is likewise considerable: by some it is stated at from three to six sacks; in other instances forty bushels or more have been obtained from the acre. This sort of seed is greatly preferred by pigeons, and it may probably be used for poultry with advantage. In the above statements the produce in green food is undoubtedly large; but from the succulent nature and luxuriant growth of the crops it cannot probably be much too high.

In the application of tare crops, there can be little hesitation in pronouncing that of soiling them with horses or other stock on the farm, as the most advantageous and beneficial method. The vast advantage of this mode is rendered particularly evident by the great loss which we have just noticed in converting them into hay. In the practice of soiling much loss may be sustained by cutting the tares at two early a period.

An intelligent agriculturist is of opinion that the farmer's stock should be wholly supported on them from the time they begin to blow till the blossoms begin to fall off, and the formation of pods takes place. On account of the risk from wet, he recommends that all the stock of a farm should be soiled on them green, as it will have the good effect of taking it off the grass land long enough to allow of its being mown for hay, and by this means the meadow may be much increased in quantity, and there will not be so much occasion for pasture, the tares abundantly supplying its place. Besides, at the time the cattle return from green tares, the grass land, in the mean time having been mown, may be ready to receive them.

It is further observed that, as it would be wasteful in the extreme to turn live stock into a field of tares, as their treading and lying down would do great mischief to the crop, even by feeding it in small patches hurdled off, the most advisable method would be to mow the tares of the first half acre, and to carry the produce into the stables, cow-houses, and fold-yards, or on to poor land to be consumed by stock, then to hurdle the growing tares from such *cleared ground*, into which put the stock and feed them all with the tares



given to them in racks, removing the hurdles and the racks forward daily to the edge of the growing tares, which will manure the land uniformly, and deposit all the urine in the soil.

In the Gloucester Report another good method is recommended, "which is to feed them through rack hurdles, which are made the same as the common five-railed ones, only leaving the middle rail out, and nailing upright pieces across, at proper distances, to admit the sheep to put their heads through. A swath of vetches being mown in the direction you wish to plough the land, a sufficient number of these hurdles, allowing one to five sheep, are set close to it: at noon the shepherd mows another swath and throws it to the hurdles, and the same at night; next morning, a swath being first mown, the hurdles are again set: thus moving them once in the twenty-four hours, by this trifling additional trouble the vetches are eaten clean off, and the land equally benefited."

In Gloucestershire and Worcestershire they sow tares as pasturage for horses, and eat them off early enough to allow of turnips being sown the same season. In wet seasons, where the tare crops are large, the stems are, however, apt to become rotten upon the ground; in this condition such food often proves prejudicial to horses; in such cases it will therefore be imprudent to cut them any longer for the purpose of soiling.

In Sussex tares are of such infinite importance that not one-tenth of the stock could be maintained without them; horses, cows, sheep, hogs, all feed upon them. The last sort of animals are soiled upon them without any other food. This plant maintains more stock than any other plant whatsoever. Upon one acre Mr. Davis can maintain four horses in much better condition than upon five acres of grass. Upon eight acres he has kept twelve horses and five cows for three months without any other food; no artificial food whatever is equal to this excellent plant. They find this crop to be a hearty and most nourishing food for all sorts of cattle. Cows give more butter when fed with this plant than with any other food whatsoever. And by one crop of vetches succeeding another, Mr. Halstead, in the same district, insures a crop the whole summer of the best food that can be given to cattle: after this he sows turnips, then wheat.

Where large stocks of sheep are kept, tares are exceedingly useful; for they come in at a time when rye and turnip crops are eaten off, and before the clovers and other grasses are in sufficient forwardness for being turned upon, and afford a seasonable supply of food for ewes and lambs. It is recommended to wait till the tares have gained a sufficient increase of stem before the sheep are turned in, and then to divide the ground by hurdles, in the same manner as is practised above. By this means there will be little waste, and the ground be enriched in a much higher degree than if the stock had been suffered to ramble over the whole crop.

As from the great closeness and shade which is produced in these crops the land becomes much improved and rendered more clean and mellow, such plants should constantly be cultivated wherever the soils and situations will admit, especially if the keeping of much live stock be the object. In cold exposed situations, where vegetation



is late in the spring months, they are not so proper: it may sometimes under such circumstances be more advisable to raise clover crops, as it will not be so much later as to render it much less valuable, and at the same time the more certain.

Tare crops form an excellent preparation for wheat in all the more strong and heavy sorts of soil, and for both grain and turnips in those of the light kinds: but as they have much effect in rendering the lands on which they grow more light, open, and porous, they may sometimes, in the latter case, bring it into too loose a state for the successful culture of a wheat crop, as it requires a rather close texture of the land.

There are other species of this genus of plants that may, probably, be introduced into cultivation with benefit to the farmer, either in the view of affording good pasturage, or as supplying large quantities of green food, though they have not yet been sufficiently subjected to the test of experiment either in soiling, feeding or pasturing of animals, to fully decide on their merits or utility.

The Bush Vetch (*Vicia sepium*) is a species of tare that promises much advantage as a pasture plant. Its roots are said to spread much laterally just below the surface, and to send forth numerous stems in the spring of the year close to each other; which, as they have abroad-tufted top covered with many leaves, a close pile is formed without any other plant. It does not rise to any great height; but from its springing up very quickly after being cut or cropped, it seems to be properly adapted for pasturage. On fertile soils, however, it grows to a sufficient height for the purpose of hay. As the stalks grow so closely together, there is, however, danger of its rotting at the root in moist seasons. Though it produces abundance of seeds, they are very apt to be destroyed in the pod by insects in their vermicular state. It appears to succeed best in clayey soils, and abounds pretty much in foliage, affording seeds similar to those of the common tare. It has been observed to shoot earlier in the spring than any other plant eaten by cattle, and to vegetate late in autumn, continuing green all winter. A small space in a garden was sown with it in drills, and in the second year cut five times, producing at the rate of twenty-four tons per acre of green food, which would be nearly four and a half tons when dry.

The chief difficulty in the introduction of this plant arises from the causes stated below. Mr. Swayne has remarked that, though very palatable to cattle, great difficulty arises in the cultivation of it on a larger scale, from the *larvæ* of a species of *attelabus* frequently devouring the seeds.

The Tufted Vetch, (*Vicia cracca*) from its rising to a considerable height in the stem and affording much foliage, might likewise be used for the purpose of eating as a green fodder, as the produce would be considerable, and the plant is easily cultivated. It would also yield a great deal of hay. It has been observed to improve the condition of poor lean cattle beyond any other plant.

The Everlasting Pea (*Lathyrus latifolius*) is also a plant which, from its large growth and foliage, might afford large supplies of green food, or of hay. A gentleman of much experience lately as-



ured me that cattle eat it with great avidity, and that it is highly nutritious: and it has been long ago suggested as capable of being cultivated with advantage for these uses by Dr. Anderson.

We wish to draw the attention of the farmer more particularly to plants of this kind, as they are not only in general extremely productive in respect to quantity of food, but, in all the trials which we have been enabled to make upon them, very nutritious and fattening. And, in addition, they have mostly the very desirable property of being eagerly fed upon by most sorts of live stock. It is not to be hastily supposed, from their appearing of a coarse nature, that they may not be of advantage even in pastures, as it is now well known that close and judicious feeding can effect much in rendering the coarsest kind of herbage more fine and grassy.

*Chicory*\*.—This is a herbaceous plant of the succulent perennial kind, that has been lately introduced into cultivation for the purpose of affording green food for the summer support of different sorts of live stock. It seems to have been first fully brought to the notice of agriculturists by the experiments and observations of Mr. Young, detailed in his very useful work, the *Annals of Agriculture*. The plant is, however, supposed by Professor T. Martyn, in his edition of *Miller's Dictionary*, to be a highly improved variety of common succory; as in its wild state that plant is dry, hard, and without much succulence. It is capable of being grown on most of the loamy descriptions of soils, and even in some of the more light brashy sorts of lands, and other poorer kinds, but succeeds the most perfectly in such as are not too much retentive of moisture. The former of the above writers says, that it affords a large supply of sheep food on poor blowing sands; and that with a portion of cock's-foot grass and burnet, it will form a layer for five or six years, better than from trefoil, white clover, and ray grass. It also thrives to much profit on fenny, boggy, and peaty lands. And where clover is worn out, it likewise answers well.

In respect to the preparation of the soil, it is probably less particular than many other similar plants, but answers in the best manner where the land is in a tolerable state of fertility, and has been rendered in some degree fine and mellow. When it is put in with other sorts of crops the same kind of preparation must be employed, but when sown alone the ground should be rendered fine by two or more ploughings at suitable seasons, according to the nature of the soil, and repeated harrowings.

*Seed*.—This is best when collected from the plants by the cultivator, as, like most other sorts, it is liable to be mixed in the shops. It vegetates in the most perfect manner when new.

The quantity of seed which is necessary for the acre must, as in other sorts of crops, of course vary according to the nature of the land and the intentions of the farmer; but the usual proportion, whether sown alone or with grain in the spring, is from ten to twelve pounds. In the row method of sowing, at the distance of a foot, from seven or eight to ten pounds may, however, be fully sufficient.

\* *Cichorium Intybus*.—It is likewise known by the title of Wild Succory.



As the plant is not of the tillering or spreading sort, a full proportion of seed should, however, constantly be put in, that the ground may be well covered with herbage.

*Time and method of sowing.*—The period of putting in chicory crops must be regulated by the method in which the business is performed, and the views of the cultivator. When it is sown without other sorts of crops, the work may be executed at any time from about the middle of March till the latter end of the summer; but with corn it must depend on the season they are put in. It is sown with both oats and barley, but the first will obviously admit of the more early sowing. From the plant being hardy, it should, probably, be put into the soil as early in the spring as possible. Mr. Young found it less liable to be injured by grain crops than other sorts of grasses, and to succeed well with most of them.

It is mostly sown in the broadcast method, after the surface has been rendered fine and covered in by a light harrowing. But from its growing with the greatest luxuriance where it is the most open and has the greatest benefit of free air, it is suggested as well adapted to the row method of cultivation. In which case it may be drilled in at nine inches on such lands as are of the poorer kind, and twelve in those that are more fertile, being harrowed in by one bout of the harrow.

*After-management.*—Where the crop has been put into the ground in the manner directed above, little attention is necessary afterwards, especially when cultivated in the common broadcast method; but where drilled in rows, the use of the hoe will be required to keep the intervals as well as the plants in the rows clean, and the ground well stirred.

Crops of this plant from the great quickness and luxuriance of their growth, are capable of being repeatedly cut in the summer months, for the purpose of soiling horses and other sorts of stock. It should not, however, be cut more than once or twice the first season, but in the following summers the operation may be performed three or four times according to circumstances. Mr. Young advises four cuttings, in order to prevent the stems from running up too much and becoming dry, sticky, and less nutritive.—The proper times are to begin about April or May, and to continue it every other month till October.

Its produce when cut green is large, affording, in Mr. Young's trials, upon the average of four years, thirty tons to the acre: this is probably, however, a larger produce than the plant is capable in general of affording.

It is not only in favourable seasons that this coarse juicy plant can be made into hay with success: nor is it well suited for the purpose, being of much greater advantage when consumed in its green state. Its produce in this way is stated at from three to four tons the acre. This sort of hay is, however, asserted to be nutritious.

When left to run up to stem and seed the produce is considerable, amounting in the third year, to more than four hundred weight on the acre.

The most useful application of this sort of crop is probably feed-



ing of cows and other sorts of cattle, and the soiling of these as well as horses, as it springs more rapidly than either saintfoin or burnet; but it is likewise found to answer admirably for pasturage for sheep; as it is less injured by close feeding than many other plants.

“ In a comparative experiment made on a small piece of land of a wet, sandy, friable, loamy soil, with marley bottom, drained, on a cabbage preparation, sowed oats with chicory and various other seeds—the oats were mown at harvest, but had only been used as the means of laying down: in May, when the grasses were mown and weighed green, those with chicory were most productive. No rain fell till the 11th and 12th of July, when it was very heavy. On the 14th of this month, cut the chicory crop: the others had not any thing worth mowing. In August, cut all again, when the chicory crop had much the advantage in quantity. In the after-grasses also the chicory was the only one productive.” From the whole of the experiment it appears that the superiority of chicory in general, over other plants in general, is very considerable, which is a circumstance principally to be attended to.

As a very large proportion of green food is afforded by this plant at a period when it is not otherwise easily obtained, its uses in soiling cattle or other animals are evident.

In a comparative experiment of stall-feeding eight beasts with tares and chicory, it appears that, on putting to tares only from May 25 to June 21, they gained  $49\frac{1}{2}$  stones; weighed again 6th July, gained 17 stones:—on this weighing they were put to chicory, the tares and that both being given to them; weighed again 13th July, only one week afterwards, and had gained  $27\frac{1}{4}$  stones, or an advantage of about 8s. 7d. per head per week.

Its utility for the purpose of pasturage is fully shown by other statements.

On an experiment being made with ten pounds of this seed over five acres, in a good strong wet loamy soil, sown with barley among clover, trefoil, rib-grass, burnet, &c. in order to remark in the pasturing whether sheep and cattle would eat it as well as those other grasses; it was viewed during part of three years, particularly in the first autumn, after the barley was cut, when a fine fleece of herbage was produced: the two following years it was mown by the farmer, and fed through the latter. It proved by the result that the chicory was always eaten by sheep, cows, and fatting bullocks, as close to the ground as any of the other plants. Though horses were in the field, no remark was made whether it was eaten by them; but in the stable soiling they ate it with avidity.

Mr. Martin found it an excellent summer pasturage for store sheep, whether mixed with clover or alone, especially on dry soils and in dry summers, as from its tap root it receives nourishment from a great depth, affords a large quantity of food, and bears eating close without any danger of drought affecting it: it should always be eaten close. It may not be proper in feeding pastures, as fat cattle must have abundance of food; for in such cases it would send up the seed-stalks too much, and they would not eat it, and by its luxuriant growth it might damage the finer grasses.



On a *brashy* soil, the Duke of Bedford found that the produce of an acre sown with this food, the first year supported seven new Leicester sheep, of about 22lbs. the quarter, for six months; and is of opinion that, on the same land, no other artificial grass would have equalled it.

There are some other plants occasionally cut and used as a green food for cattle, such as Buck-wheat (*Polygonum Fagopyrum*) and Winter Barley, &c.

And it seems probable, from some trials which have been lately made, that the latter, as being extremely hardy, and affording an abundant produce, may be grown with much more advantage as a green food for the purpose of soiling and the support of stock, than the former.

*Proportion between Arable and Grass Lands.*—As we have already pointed out the sorts of land that seem most adapted to the purposes of tillage, it may here be necessary to say a few words on the proportion that ought to exist between the arable and grass land on the same farm.

It is evident that this must be much influenced by local circumstances and other causes, which have merely a relation to particular cases; and they must vary in a great degree, according to the nature of the soil, the methods of management that may be adopted, and the quantity of stock that is to be kept. On clayey soils a much larger proportion should be kept in grass than on most others, especially when tenacious and not easily drained, as green winter food is scarcely to be obtained at all, or not without much trouble, difficulty, and expense; of course the working stock, and such a number as are kept for consuming straw and making dung, must depend in a greater degree on meadow hay than upon soils which admit of the turnip and cabbage culture. Clover, indeed, succeeds on clays, but is uncertain and liable to failure: consequently, without a certain resource in the hay of natural grass, much inconvenience must frequently be sustained.

In the experience of the Rev. Mr. Young they have been found, when in the proportion of one-half, to be conducted in a more profitable manner than in a smaller proportion, and not to allow of being managed with advantage in less than one-third under the state of sward.

In loamy soils, it is probable that a third or a fourth in grass is the proportion that may be most suitable, and the more they tend to wetness the larger the proportion. Grass is not, however, so necessary on these soils, as clover and other artificial grasses of the same kind are less liable to miscarry, and they admit the alternate husbandry of grass and grain in a more easy and profitable manner.

In the sandy sorts of land, there should probably be as little as possible in the state of grass; they are, perhaps, best managed when nearly the whole is under the plough, as by means of proper cultivated grasses, &c. the whole stock of the farm may be profitably supported, and the land rested sufficiently for ensuring a continued production of grain. But in opposition to this rule, and most unprofitably, large tracts, in many districts, are commonly withheld



from the plough, under the name of barren heath land, &c. which by alternate tillage and rest would produce more grain and keep more sheep than in the present state.

The different descriptions of calcareous soils may also be the most productive in a state of arable cultivation, or with but a small proportion of grass. In some of the south-western districts, from the farmers not being allowed by the land-owners to plough up down lands, too large a proportion remains in grass for admitting the most advantageous cultivation. However, the degree of fertility which they have in many cases attained, may in some measure justify the practice, on account of the support afforded to sheep stock in the winter.

In peaty soils, from a great proportion of them seldom being in a state, for want of proper draining, fit for tillage, the arable should form a smaller proportion to the grass than in other cases; it can, however, only be fully regulated by local circumstances.

But, besides these, the modes of application in which the lands are managed must have considerable influence in regulating the proportions which the grass should bear to the arable, as where grazing, dairying, or the making of hay are the principal objects of the farmer, the whole of the farms are mostly in grass. In the two first of these cases it is probable that the farms might be more profitably conducted by having a small proportion in tillage, as from a fourth or fifth to a tenth, according to the nature of the lands, and the extent of cattle and horses that may be kept, as by this means not only straw for litter may be more conveniently obtained, but likewise green vegetables for the partial support of the stock, which must otherwise be often procured at great inconvenience and expense. In the case of hay farms, as they are mostly in the vicinity of large towns, it may, perhaps, in most cases, be better to purchase the straw than provide it by tillage, as little will be necessary, from small teams only being required.

*Hiring and stocking Farms.*—The business of hiring and stocking farms deserves more attention than is commonly bestowed upon it. For the present purpose, it is however only necessary to place before the farmer the principal circumstances which ought to regulate his conduct, as the subject has been very fully handled by an agriculturist of much practical experience.

The changes in regard to farming property are in general, in the more southern parts of the kingdom, made about Michaelmas. In these the farmer should deliberately consider the nature of the soil, the climate, the relative situation in respect to the convenience of improvements and markets, the size in regard to his capital, the manner in which the inclosures are disposed with respect to each other, the management of the former tenant, the covenants by which he is to be fettered, and finally, the amount and arrangements in regard to rent. Having made these considerations with proper minuteness and attention, weighing their advantages and disadvantages in his mind, without suffering himself to be influenced by probable causes, he may be enabled to bring their benefits into



competition with their disadvantages, and to compare the former with the amount of rent which he is required to pay, in such a manner as to decide on the propriety or impropriety of his engaging them. In this matter great care should however be taken, that real inconveniences or difficulties be neither too much magnified nor too greatly despised, so as to produce a too hasty or too protracted decision; from both of which, evils may proceed. By the latter, the securing of an advantageous farm may often be lost, while the former may lead to the engaging of one that is not by any means adapted to his circumstances. In these cases the farmer should never suffer himself to be too much influenced in his determinations by the circumstances of the preceding occupiers, as so much depends upon management that with one sort there may be considerable loss, while under another a very adequate profit may be derived.

The circumstances in respect to the nature of the soil, which have been chiefly directed to be attended to by Mr. Young, in fixing upon a farm, are these: "stiffness, moisture, exposure, levelness, slope, stoniness: what draining, manuring, fencing, &c. will be wanted: the roads, distances of market, prices of commodities, labour, &c. the state of tithes or gathering; the poor rates; the compactness of the fields, and covenants relative to cropping;" as "many such are extremely detrimental to a good conduct of the land." And "one general rule in hiring a farm should not, he says, be forgotten—to fix on good land, and he can scarcely pay too much for it; but for poor soils, the least rent is sometimes too high to be consistent with profit. By poor soils, however, are not to be understood such as have a command of lasting manures, that work great improvements; nor waste lands, which, under that false denomination, often are of all found the most profitable."

It is observed "that the sound, mellow, rich, putrid, crumbling, sandy loams are of all soils the most profitable; such as will admit tillage soon after rain, and do not bake on hot gleams of sun coming after heavy rains, when finely harrowed: such land is better worth forty shillings an acre than many soils deserve five. The next soil is that of the stiff loam, which is nearest allied to brick earth; this, till drained, is in general an unkindly soil, without plenty of manure. It is known in winter by being very adhesive upon walking over it: is long in drying, even when little or no water is seen upon it; for which reason it is generally late in the spring before it can be ploughed. When quite dry it breaks up neither so hard and cloddy as mere clay, nor near so crumbly and mellow as the good loam. If it is in stubble, it is apt to be covered with a minute green moss. There are many varieties of this soil, but all agree in most of these circumstances; and in being what the farmers call poor, cold, hungry land. When hollow-ditched, and greatly manured, it yields any thing; but those who hire it should forget neither of these expenses."

It is added, that "the gravelly soils are numerous in their kind, and very different in their natures. Warm, dry, sound gravelly loams are easily distinguished in winter. They admit ploughing all winter through, except in very wet times; always break up in a



crumbly state of running mould ; and, if a stubble, will dig on trial by the spade, in the same manner. If under turnips, you may perceive, by walking through them, that it will bear their being fed off. The wet, cold, spring, gravel is a very bad soil ; it is known in winter by the wetness of it ; and in spring, by its binding with hasty showers. It rarely breaks up in a crumbly state, or shows a mellowness under the spade. Very expensive drains greatly correct its ill qualities, but it requires a prodigious quantity of manure to fertilise it. Some gravels are so sharp and burning, that they produce nothing except in wet summers ; but such are known at any season of the year. Sands are as various as gravels, and are all easily discoverable in their natures. The rich red sand is, he believes, as profitable a soil as any in the world. It has at all seasons a dry soundness, and at the same time a moisture without wetness, which secures crops even in dry summers. The spade is sufficient to try it at any season of the year. The light sandy loam is likewise an admirable soil : it will bear ploughing, like the preceding, all winter long, and appears quite sound and mellow when tried with the spade. If it lies under a winter fallow, the best way to judge of its richness is to remark the state of the furrows, and the degree of adhesion in the soil. Stiff land being dry and crumbly is a great perfection, and sand being adhesive is an equally good sign. When, therefore, the farmer views a light sandy loam, whose sound dryness is acknowledged, he may presume the soil is rich, in proportion to its adhesion. If it falls flat in powder, and has no adhesion, it is a mere sand. The white chalky marm is often cold and wet, will not bear ploughing in winter unless the weather is very dry or frosty, runs excessively to mortar with a heavy shower when in a pulverised state. It is a cold soil of little profit, except with peculiar management ; but answers best when dry laid down to saintfoin."

It is concluded, that " it should be laid down in general as a maxim, that strong harsh tenacious clay, though it will yield great crops of wheat, is yet managed at so heavy an expense, that it is usually let for more than it is worth. Much money is not often made on such land. The very contrary soil, a light, poor, dry sand, is very often in the occupation of men who have made fortunes. Some permanent manure is usually below the surface, which answers well to carry on : and sheep, the common stock of such soils, is the most profitable sort he can depend on. All stiff soils are viewed to most advantage in winter : the general fault of them is wetness, which is in the greatest excess at that season of the year. If the fields are level, and the water stands in the land, notwithstanding the furrows are well ploughed and open, it is a sign that the clay is very stiff, and of so adhesive a nature as to contain the water like a dish. It is likewise probable, that draining may prove insufficient to cure the natural evil of such land. This kind of soil likewise shows itself in the breaking up of stubbles for a fallow ; a very strong draught of cattle is then necessary to work it. It breaks up in vast pieces almost as hard as iron. When it is worked fine it will run like mortar, with a heavy spring or summer shower. These soils will yield



very great crops of beans and wheat, &c. They must, like others, be cultivated by somebody; but he would advise every friend of his to have nothing to do with them; never to be captivated with seeing large crops upon the land; for he does not see at the same time the expenses at which they are raised."

It is stated that "peat, bog, moor and fen, in many variations, are very profitable; but the expenses of improvement demand a calculating head. The vicinity of lime or marle is then of great importance."

He says that, in respect to grass lands, the marks for judgment are different. These are best examined by attending, first, to the circumstances in which they are most deficient; and then to such as are in their favour. The more seasons grass fields are viewed in the better; though any one is sufficient for a tolerable judgment. One evil attending these lands is, that of being too wet; the signs of which can never be mistaken or overlooked in any season of the year. In winter, it is at once perceived by walking on them; at all times of the year by the herbage which generally abounds on them; such as rushes, flags, and a great quantity of moss: and also by the colour of the grass, which is mostly blue at the points, sometimes of a dirty yellow hue, and always coarse. If the soil is the first described, stiff clay, and the surface level, the evil will be very difficult of cure; if of the other sort of clay, or stiff loams, draining will have great effects. Grass fields on gravelly soils are, if the gravel is sharp, very apt to burn in dry summers; but they give great and sweet crops in wet ones, provided the land is a gravelly loam. An absolute gravel should never be under grass. A farmer should not, however, regret having a pasture or two of this sort in his farm, being of excellent use in winter for feeding sheep and lambs on with turnips, &c. The low meadows, whatever the soil, on the banks of the rivers and brooks, are in general good, but often subject to the misfortune of being overflowed in summer; which not only ruins crops of hay before they are cut, but carries them away perhaps when just made. Many grass fields on all soils, consist of so bad an herbage as to be of little value; made up of weeds and the worst and coarsest of grasses: if a landlord will not allow such to be ploughed, the farmer should minute the rent accordingly. This fault is visible at all seasons. A river that does not overflow, running through a farm, is a very favourable circumstance, as it indicates a probability of all the grass fields being well watered, that is, for cattle. And in many cases it may be converted to the purpose of irrigating the land.

If the climate be mild, and the lands well sheltered from the effects of the north and easterly winds by tracts of high grounds or woods of some extent, they are in many cases circumstances of a favourable kind, especially where much of the farm is to be conducted under the grazing system.

The situation of the land near towns, where the markets for the disposing of their different products are good; and in many cases near large cities, where the produce of several different sorts can not



only be disposed of to much advantage, but manure in abundance be procured and brought back in return, is also a point that should not be unattended to in the taking of a farm. And if lime, marle, or other substances capable of being made use of as manures, be near at hand, they are of great importance in the management of land, and should have their due influence with the farmer in his fixing himself in a farm: Besides these, there are various other local circumstances and advantages, that may operate in different cases with propriety in directing his conduct in the business of taking a farm.

It is a matter which Mr. Young justly considers of the greatest consequence in the engaging of a farm, that no larger a one be taken “than the sum of money a man can command will stock properly. A common fault among farmers is, he says, the hiring too much land for their money: they are extremely eager to farm as much as possible; the certain consequence of which is the conducting the soil in an imperfect manner. In the neighbourhood of great cities and towns, variety of manures are to be had, in some places cheap; but if the farmers have not money, how are they to make use of such advantages? For these and other reasons, a farmer should not think of venturing on a tract of land which he cannot command, that is, farm as seems best to him.”

It is obvious that a variety of advantages in the management of a farm must result from the different fields being connected, and not situated at a distance from each other: much time and trouble must constantly be saved, besides many other conveniences being attained. It has been remarked by the above writer, that “many farmers too often overlook this circumstance. If they attended to it, as much as their profit required, we should see landlords reforming their estates in this particular more than many do at present. There is not a more expensive, perplexing circumstance in a farm, than the fields being in a straggling, disjointed situation.”

Where the exertions of the farmer are to be clogged with such restrictive clauses in the lease of a farm as must prevent him from cultivating it under the most advantageous method of husbandry, there is every reason for his considering the matter well before he agrees for the farm, or he may find himself injured in a much greater degree than is easily conceived. The author of the *Farmer's Calendar* has observed, that “the merit or reasonableness of covenants must be considered always on comparison with the nature of the farm. It is for want of this consideration that unreasonable covenants are ever proposed. These prohibitions are foolish, but sometimes admissible: they must depend on local circumstances, to be well weighed by the farmer who hires.” “The principal point here necessary to touch on, is the combination of rent, tithes and rates, in one sum. Knowing the capital intended to be invested, estimate the interest of it at not less than ten per cent. and then calculate the expenses and produce; the former deducted from the latter leaves that sum which the farmer can afford to pay in these three species of rent. Deduct further the tithes and rates, and the remain-



der is what he can afford to pay to the landlord. If rent be valued in any other way, it must, he says, be erroneously and deceitfully done, and no dependence can be placed on it."

The mode of paying the rent may likewise in some instances demand the notice of the farmer in engaging a farm.

In the stocking of farms there will be considerable difference according to their nature, situation, and manner in which they are conducted; but an adequate capital should always be employed, or there will be great loss sustained. It has been observed by Mr. Young, that "thirty years ago, the sum that was usually appropriated to stocking a farm varied from 3*l.* to 5*l.* an acre; and it was a general idea, that the latter sum was sufficient for any farm, part arable and part grass, of no uncommon fertility. Rich marshes were, of course, excluded in the calculation; and light stock farms were often stocked for 3*l.* per acre. But these matters are now greatly changed; rents are much increased; tithes are compounded at a higher payment; poor rates are enormously risen; all sorts of implements, comprehended in the article wear and tear, are thirty or forty per cent. dearer; labour in many districts doubled; the prices of cattle and sheep are greatly advanced; so that at present the same farm which at that period would have been very well stocked, and the first year's expense provided for at the rate of 5*l.* per acre, now demands from 7*l.* to 8*l.* per acre. In all such estimates it is, he says, necessary to suppose that every implement brought in is new, that the live stock be good of the sort, and the first year's expenses be provided for, though a portion of the crop may come in before the whole payment is made. A man cannot be at his ease if he does not thus provide; nor will he be able to make that profit by his business with a small capital, which will attend the employment of a larger. By profit he would be understood to mean a per centage on his capital, which is the only satisfactory way of estimating it. If by stocking a farm with 5*l.* per acre, he makes seven or eight per cent. profit; and by stocking, in proportion of 8*l.* per acre, he makes ten per cent. (and this difference will, he believes, often be found), it must be sufficiently apparent that the loss by the smaller stock is a serious evil. It will depend much on situation and local circumstances; the benefit of procuring manures, or litter to make dung, may in some places be very great, in others much less: but not to be able to profit by every favourable opportunity that may attend the spot on which a farmer is fixed, must be highly disadvantageous. To irrigate land is an expensive operation; but to omit or postpone it, for want of money for the undertaking, is to lose perhaps the capital advantage of a farm. Cases of this sort might be greatly multiplied; and there is not one that does not call on the farmer for an ample capital."

The same able author justly remarks, that "of all farms, a warren is hired with the smallest capital; but that there are marshes in Lincolnshire stocked at the rate of above 30*l.* per acre. And the annual expense of many hop grounds amounts to 30*l.* and the capital above 60*l.*"



He supposes that “if a farmer does not make ten per cent. on his capital, he must either have a bad farm or bad management, or the times must be unfavourable. He ought, he thinks, to make from twelve to fifteen per cent. Some farmers make more when corn is at a fair price.”

Besides proper attention being bestowed in these different respects, the farmer should constantly take care that the live stock be of such kinds as are best adapted to the nature and situation of the land, as, without due regard in this particular, great loss may be constantly sustained. It is never advisable for him to have recourse to the more fine or fashionable breeds, except where the nature of the soil is well suited to them, and other conveniences fully justify their introduction.

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# THE FARMER'S COMPANION.

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## PART THE FOURTH.

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### SECTION XIX.

#### *Cultivation of Grass Land.—Meadows.*

**L**ANDS in the state of grass must obviously be applied to different purposes according to their nature, situation, and other circumstances. Those which are of the more moist and wet kinds, whether from the nature of the soil or the peculiarity of situation, and which have been a long time in the state of sward, are for the most part kept under the scythe; while those of the contrary description, that are situated at a greater height, and of course, in most cases, possess a greater degree of firmness, are in general appropriated to the purpose of pasturage—though, in particular situations where grass land is scarce, and consequently of great value, they are likewise occasionally converted to the purpose of hay. As grass plants grow to the greatest height in situations where a considerable degree of moisture is constantly preserved, and of course afford the largest produce, it would seem that the practice of keeping moist lands under the scythe is right on this account, as well as that of their being less firm and solid in their texture, and their mostly producing a coarser herbage. The more elevated grounds, as they bear the stock generally with less injury, and often afford both a more fine and sweet feed, are with propriety converted to the use of being fed down by cattle and other animals. But by a suitable management in the feeding down, and use of manure, these sorts of land may even be brought to afford a considerable produce in hay.

*Meadow Lands.*—The common meadow lands, from their being situated in the hollows and sloping sides of the valleys, where the staple and depth of soil of the lands have for a long time been continually increasing by the deposition of various sorts of vegetable and other matters brought down from the higher grounds, are however, in general, in a considerably greater state of fertility, and evidently better fitted for the permanent production of grass than those from which they have derived their richness. It has been well observed, that this sort of land of all others is the most productive of grass and hay, yielding sustenance for cattle through the summer and



winter, and producing an everlasting source of manure for the improvement of the adjoining up-lands ; and that in all cases of extensive inclosures, the improvement of the vale land, or that formed by nature for meadow and pasture, should be first attended to.

But as, from their greater retention of moisture, in consequence of their situation, and the depth of vegetable matter, they are liable to throw up coarse herbage in many cases, more drainage, as well as other management, is necessary to bring them into the proper condition for the growth of good herbage, than is requisite in the hay grounds in the more elevated places. And by a more particular attention in these respects they would, in many instances, be rendered a vast deal more productive than they are at present, and at the same time afford a much better and less coarse herbage. They would also admit stock upon them a much greater length of time, both in the autumn and spring seasons.

The most proper season for surface-draining grass lands is in the autumn, when they are somewhat firm and dry, as in the early spring months such lands are too full of moisture. The grips, or small open drains, should be cut obliquely, in the most suitable directions for conveying off the superficial stagnant water, the materials taken out being wholly removed. Much of this sort of draining may be performed at a small expense, and the beneficial effects be very considerable.\*

Besides, such meadow lands demand much more attention in their management in other respects, as those of their being fed by cattle, and the performing of the different operations that are proper for rendering them productive of good herbage. In these cases stock should be turned upon the lands, and manures applied with much care, and only when the land is in such a state of dryness as not to be injured by the approaching in or breaking of the sward. The higher and more dry sorts of grass land, in most instances, admit of considerably more latitude in performing these different operations, as they are capable of admitting the stock, as well as the dung-cart, more early in the spring months, and of suffering them to remain to, or be applied at, later periods in the autumn, without inconvenience. The advantage of this attention is rendered sufficiently plain by the effects which the contrary practice produces in such meadow and other hay lands as are in a state of commonage, where the stock is admitted at all seasons and under all circumstances.

As it must be evident to the most superficial observation, that the breaking of the surface, texture, or sward of grass lands must in all cases be prejudicial, not only by the destruction of plants, which is thereby immediately produced, but also by the retention and stagnation of water upon them in the holes and depressions from small portions of the turf being forced in ; the necessity and utility of clearing and removing all sorts of live stock, and especially those of the heavy kinds, in both these descriptions of meadow lands, when intended for hay, becomes strikingly obvious. In a piece of clayey meadow land exposed to the treading of cattle during the wet season

\* Section on draining of Land.



of winter, with the view of fully ascertaining the effects of the practice of suffering cattle to remain too long upon grass hay lands, it was found that after three years, notwithstanding every possible care and attention being employed in rolling, manuring and sowing grass seeds, it was not restored to its former state of sward.

And it has been remarked that on the deep, tough, yellow, clayey grass lands, in Middlesex, every care is taken to prevent the least degree of poaching by cattle, as “it is well known that wherever a bullock makes a hole with his foot in this kind of soil, it holds water and totally destroys every vestige of herbage, which is not quite replaced till several years after the hole is grown up.”

The exact period of performing this business cannot be easily regulated by any fixed rules, as it must always depend much on season; but it should never, on any account, be delayed after the grounds have become so much impregnated with moisture as to easily give way to the tread of the animals. In the autumn season the heavy cattle should perhaps seldom be suffered to remain on the softer sorts of lands longer than the beginning of November; but in those of the more dry kinds they may be let remain to the end of that month with safety. Sheep stock may however in the drier kinds be continued till February, or later. And in the spring season, if pastured at all, they should not be admitted upon such lands till they begin to possess a proper degree of firmness; which will depend on the various circumstances of the preceding season. On the more low and moist sorts of meadow land it can, probably, seldom be ventured earlier than the middle or latter end of March.

But it is obviously a much better practice, especially where hay is the main object, not to eat them down at all, or very little, with cattle in the spring, and not so much, as is the usual custom, with sheep; as it is plain that by this means the cultivator will not only ensure a more abundant produce, but a much earlier one; and, of course, have more advantage in the making it into hay and securing the crop.

And where the lands are fertile and the grass springs quickly, as is often the case near large towns, where manure is plentiful, it may be advantageous in the view of having a second crop; as by that means the after-grass may be cut more early, and be less in danger of being well secured. Besides, in all events, the after-math will be in a more forward state, and, of course, ready at a more early period for the admission of stock of different kinds; which, in many cases, is a circumstance of great importance to the farmer.

The most proper periods of shutting up such grass lands as are designed for hay must, like those of eating them down in the autumn by stock, depend on various circumstances that can only suit the particular cases. In general, however, it is the best practice not to delay it too long. When the lands are not eaten at all in the spring by cattle, after the sheep have been removed, about the middle of February, nothing further is allowed to enter the meadows: by which means a quick vegetation is secured, as well as a more plentiful crop and a more early hay harvest. And in other cases it should probably seldom much exceed the beginning of April, as when



eaten much later, especially in the southern districts, there is not time for the grass to produce a full crop before the commencement of the hay season: of course, the farmer sustains more loss than can be repaid by any advantage in the additional feeding he may obtain. This is therefore the best practice where the view of the farmer is hay; and it should be particularly adopted and attended to in cow farms, where it is of much importance to cut early, and at different times, in order to secure hay of a fine, soft, grassy quality, for the purpose of producing large supplies of milk. In these cases it is cut two, three, or more weeks before the usual period, as it is found better not to let the seed-stems rise.

After the meadows or other grass lands have had the cattle and other sorts of live stock removed from them in the early spring months, and been shut up for hay, they should be prepared for the scythe by having all sorts of obstructions picked up and removed. This work should always be executed as soon as possible, before the grass begins to spring up too much and conceal them, as it is difficult to perform the business effectually afterwards.

*Extirpating coarse Plants.*—It is an excellent practice, but one that is too much neglected by grass farmers in general, to have all sorts of coarse plants of the aquatic and other kinds, such as rushes, fern, docks, thistles, and various others, effectually drawn up and eradicated both from the hedge rows and other parts of the field, in order to prevent their running up to seed and disseminating themselves over the lands, and thus not only filling them progressively with all sorts of trumpery, but greatly injuring the herbage. In a field on an extensive hay farm in this neighbourhood, on perceiving the whole surface thickly studded with thistles, it was found that this sort of plants had been suffered to flower and perfect their seed annually, till the lands on every side had become fully stocked, to the vast injury of the crops. The same thing takes place with the dock and several other noxious plants; which strongly enforces the utility of the practice just recommended. The annual expense of performing the business is but a mere trifle, while the advantage must be real and permanent. The saving to the farmer would be considerable by having the work regularly done as soon as the weeds fully show themselves, and, at the same time, his young hedge plants be prevented from being destroyed, by being shaded and choaked up by so many weeds. In order to take them up in a perfect manner, a narrow implement of the spade kind, such as is made use of in forming narrow drains, may be employed with advantage, as cutting or breaking them off is by no means effectual. After such plants have been removed and the ground well cleaned, sowing the banks and hedge rows with the best grass seeds, white clover and other plants, might be an excellent practice, as in this way, the lands may be improved rather than injured.

Most of the varieties of thistle are either annual or biennial plants except the *Common Sow Thistle* and the *Common or Field Thistle*, which are both perennial. The former however, though a troublesome weed in arable lands, is rarely met with in those of the grass



kinds. It is obvious therefore from their nature that all the other sorts may be readily destroyed by proper attention in cutting them so as to prevent their seeding: and the common thistle by frequent cutting in the bleeding season.

An effective implement for this purpose has been contrived by Mr. Amos, by which they are not only cut more cheaply, but much nearer the ground, than where the scythe is employed. With one man and a horse twenty acres may be cut in a day. It is advised where the lands are in pasture that as soon as the thistles are in full flower the tool should be set to work in the lengthways of the ridges where they exist, the cutting parts being kept very sharp. When they have been cut a day or two, and are withered by their exposure to the sun and air, the ground should be cleared, and well rolled in a cross direction, with a very heavy roller; which, it is said, so crushes the hollow stumps and renders them pervious to water, that the roots quickly decay and become rotten. It is also capable of being used for other strong weeds, and its operation is rendered more effectual by having the lands previously cleared from rubbish and subjected to the action of the *Sward-dresser* and roller in contrary directions. Both these implements are represented in his Minutes of Agriculture and Planting.

Plants of the rush kind may be easily removed by preventing the stagnation of moisture near the surface, by judicious under or surface draining, and the application of substances of the saline or calcareous kinds, such as ashes, lime, drift from the roads, and other similar materials. These are best made use of in a dry season, in either the autumn or spring; but the latter is probably the best, as these absorbent materials will thereby be made use of at the time such plants begin to shoot and establish themselves, and when there will be the least danger of their operation being lessened or prevented by too great a degree of moisture. It has been observed, that in naturally coarse meadows, or such as become so in consequence of rushes growing upon them before they have been rendered sufficiently dry by draining, it forms a great improvement to apply a thin coat of sand evenly over the surface of them, in the proportion of from twenty to thirty common loads. By this means the sward is rendered much finer, and a much better sort of herbage brought up; white clover being predominant in most cases.

There is another method that, in particular situations, may be more easy and convenient, and which has been found to quickly destroy plants of this coarse kind by bringing up those of a finer description. This may appear extraordinary at first to those who have not seen its sudden and astonishing effects in this way. It is that of conducting water over the surface of such grounds; but in this intention it should not be suffered to have the least degree of stagnation, but be conveyed off with as much expedition as possible by suitable drainage.

*Moss.*—In particular cases there is another sort of plant that is apt to fix and establish itself upon the surface, as in old grass lands, both of the meadow and pasture kinds, that are of a clayey nature



and situated in cold exposed districts, to the great injury and destruction of the natural grasses. This is that of moss, which is a vegetable that spreads and extends itself upon the surface, not only choking up, but depriving the grass plants of the nourishment that is necessary for their support and healthy growth. Various means have been proposed by writers on husbandry for the removal of this most destructive vegetable. But as it requires a considerable proportion of superficial moisture to promote its growth and extension on the soils which it infests, it is probable that the application of such substances as have a tendency to absorb and take up the superabundant degree of wetness by which it is supported, must be of the greatest utility and advantage.

In this view lime has been applied alone evenly over the surface, in such cases, with much benefit. We have, however, experienced superior advantage by covering mossy grass lands with a thin even coat of attenuated calcareous matter, in union with a sandy material, such as is scraped up from roads, when formed into a compost with about one-fourth part of well-rotted farm-yard dung; as by this application the growth of the old grass plants is not only rendered more strong and healthy, but a new and more vigorous description of grasses brought up which soon over-power the moss plants, and thus wholly destroy them. For the same purpose, and at the same time promoting the improvement of the lands, as well as bringing the herbage into a finer state, the penning or folding of sheep has been advised. In this practice advantage is obtained in different ways, as by the effect which the treading has in opening and removing the close netted texture of the moss, and that of the urine and dung in promoting the more strong growth of the grass plants. This method may probably be had recourse to with the most success either in the close of the summer season or early in the spring months; the latter is, however, to be preferred; as, from the grass immediately covering the surface, more effect may be produced in smothering and destroying the mossy vegetation.

Harrowing with short sharp-tined light harrows is likewise a practice that may be found useful in some cases, especially previous to the application of such substances or compost as have been just mentioned; as, by such means, the matted nature of the moss is broken down, and rendered more open and fit for admitting the manure to the roots of the grass plants, and exerting its full influence in promoting their vigorous growth, and, at the same time, the spreading of the moss in some measure prevented. After such harrowings have been performed, some have recommended it as an advantageous practice to sow grass seeds, and especially white clover, over the surface.

This business may be accomplished in a more easy and effectual manner on meadow land, whether mown or pastured, by being scarified and dressed with the sward-dresser, from about the middle of February to the middle of the following month. In common, dressing the land in one direction may be sufficient; but where the sward is much infested with the mossy material, or of an adhesive quality, it is better to have it done in different directions, being after-



wards cleaned and rolled. And in order to thicken the sward where it is thin, it is recommended to lay eight or ten tons of rotten dung on per acre, spreading it very evenly, and then sowing over it, as in the former case, a mixture of seven pounds of white clover, four pounds of wild or cow clover, with four pounds each of trefoil and rib grass, and one peck of the best rye grass, before it is bush harrowed.

It has likewise been remarked that by the practice of scarifying, the burthen of hay is greatly increased by having the surface loosened so as to give the roots the power of a new vegetation, as the fault of most pastures or grass lands is their being quite bound and hard, which is of course increased by rolling. Much improvement is supposed in many cases to be thus effected, and that vast utility is produced, where it precedes the application of manure, as without it difficulty is experienced in getting it below the surface for the support of the roots of the grass plants: but after such scarifyings it comes at once in contact with the roots, consequently a much less quantity may be sufficient, than where employed in the usual method.

*Sticks.*—As small portions of rotten or other sorts of sticks are frequently dispersed over the surface of grass lands, from the hedges and trees, by the winds, or left by the hedges during the winter season, they should constantly be raked together or picked up, and conveyed from the land at the time the ground is shut up for hay: as, where this is neglected, they afford much obstruction to the scythe, and render the work incapable of being performed in a complete manner.

*Stones.*—The removal of these is equally necessary with those of sticks, as they are not less injurious in impeding the progress of the mower; the practice of suffering such sorts of materials to remain blended with the manure, and set upon the lands with it, as is commonly the case in this as well as many other grass districts, is not less slovenly than reprehensible. It would be much more easy, and far less expensive, to separate them during the time the manure is turning over and preparing for its application: and thus the trouble, expense, and occasional neglect of having them afterwards picked off, would be avoided. When gathered up in the fields, they should not, as is too commonly the custom, be thrown together into heaps on the grounds, but be wholly removed, either into the gate-ways or other suitable places; as, when left in the heaps, they are not only liable to be again dispersed on the lands, but injure them by their remaining and bringing up coarse grasses.

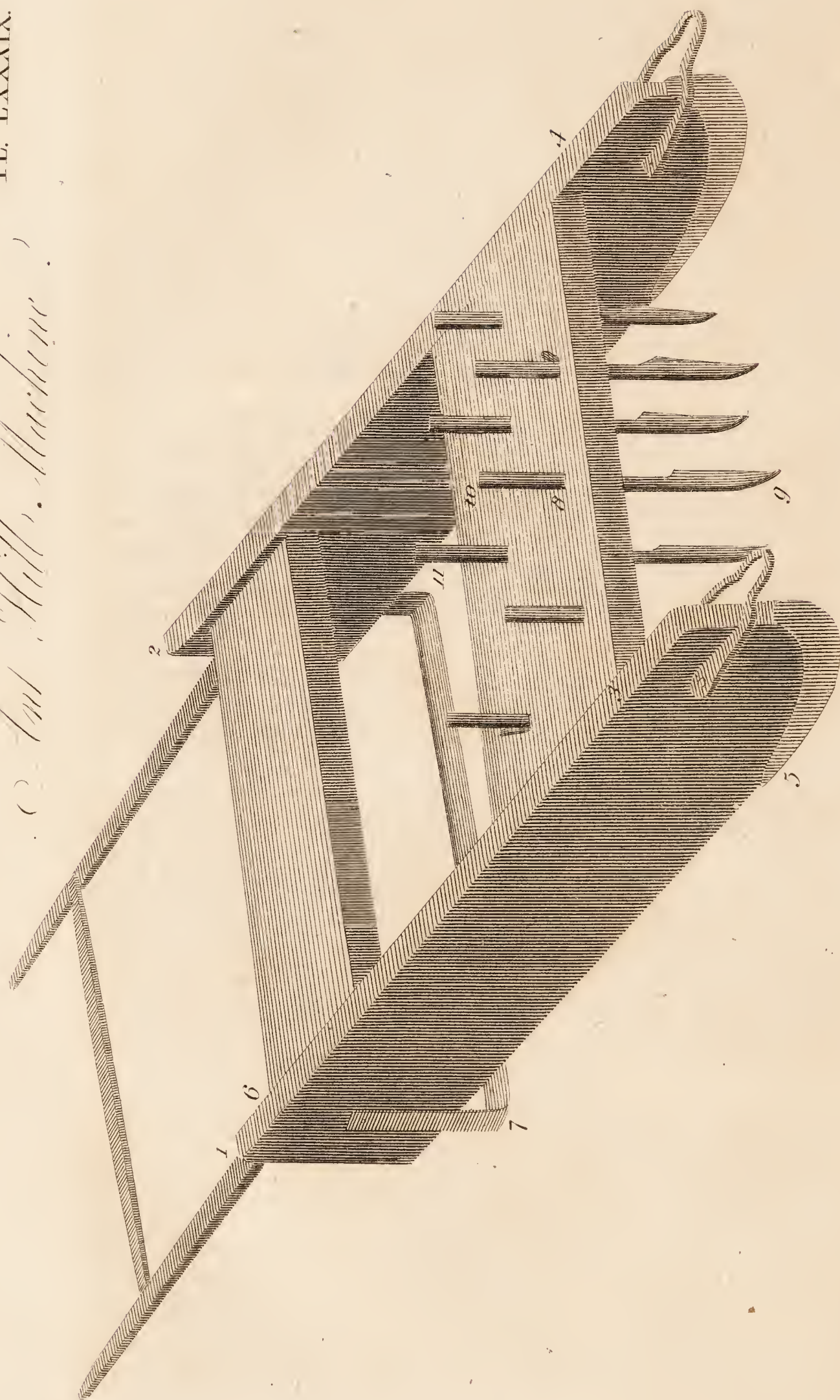
*Cattle-Dungbills.*—These are always necessary to be spread out as soon as the work can be conveniently performed after the stock has been removed; as the longer they are suffered to remain, the greater the injury the sward sustains by being made tender in the places they cover, and their preventing the natural grasses from rising, as well as bringing up coarse plants, in some cases, afterwards. In spreading the heaps, care should be taken to break them well, and disperse them as evenly on the surface as possible: as, where this is not done, from becoming hard they are apt to impede the scythe.

*Ant-hills.*—Where grass husbandry is perfectly understood, and











the lands kept under a proper state of management, hills of this sort are seldom or ever met with ; it is only where the lands have been neglected, or conducted under an improper system of cultivation, that they prevail either in meadow or pasture lands. From the greater degree of dryness in the latter sort of land, they are more frequently found in them, especially where the sward is old and mossy. Under circumstances of the latter kind it may, in some cases, be a more advisable practice to break up the land altogether, than endeavour to remove the hills and destroy the insects. But in many instances they may be removed without this trouble, and the land be restored to the state of good sward. Two methods have been chiefly depended upon in bringing these sorts of land into proper order ; which are those of cutting the hills over in cross directions, and hollowing out the internal mouldy part, and then laying the turfs down again, in an even manner, over the places where the hills stood, the earthy materials being afterwards chopped small and spread evenly over the land ; and of paring them wholly off even with the surface of the ground, and depositing them in heaps, in proper places, that they may rot and decay, so as to become in a state of fine mould, and be mixed up with lime in the proportion of a third or fourth, according to the circumstances of the land, and then spread out thinly over the same ground. Both these modes may, probably, be practised with advantage under different circumstances ; as, where the fields are in sight from houses, or otherwise much exposed to view, the former may be the more adviseable as rendering the ground less disagreeable to the eye ; but under other circumstances the latter will be the most proper, not only as more effectually extirpating the ants, but as affording a more lasting improvement to the land. A machine for this use is seen in the annexed plate.

In either method, heavy and frequent rolling should constantly be had recourse to afterwards, as it is in a great measure from the want of this that the hills are at first produced. It is indeed rendered extremely probable by the fact stated below, that this practice may alone, in many cases, effectually remove this sort of hill. In the rolling down of ant-hills instead of cutting them up, in an experiment made by the duke of Grafton, it was found to be attended with complete success. A large pasture which had been very much infested with ants, and which they had almost covered with hills, was perfectly restored by repeated heavy rollings.

In these cases, the rollings should be performed both in the autumn and spring seasons, when the lands are in such states of moisture, as just to admit the impression of the roller, without receiving injury from the feet of the animals. If such operations be executed when the grounds are in a state of considerable dryness, the benefits will be comparatively small. The good effects that are produced in this process depend upon the degrees of consolidation effected ; as it is only by this means that the insects can be prevented from carrying on their various operations ; a certain state of lightness as well as fineness in the mould being essential to the complete execution of their labours.



Other modes of destroying these insects, and preventing the formation of their hills, have been made use of. As the economy of the ant requires the situation and soil to be dry and friable, in order to carry on their works, it is probable that, in lands that will admit of the practice, it may be an easy and convenient method of destroying them, and preventing the bad consequences which their labours produce on the surface sward, to conduct water over them; and thus, at the same time, exterminate the colonies of ants and irrigate the ground; by which two improvements may be effected at once,—the land being cleared from ant-hills, while its fertility is considerably increased.

The use of night soil, in composition with various sorts of earthy materials, has been recommended with the intention of destroying such insects, but we suspect that it can only be effectual in cases where they have not attained any great height.

*Mole-hills.*—In the more rich and fertile soils, hills of this sort are frequently thrown up in great numbers, from their abounding more with the food of the subterraneous animals that produce them. Meadows are often extensively and seriously injured in this way. On account of their depth of soft humid soil, moles usually reside, destroy, and render useless the grass, not only of the very spots where the hills are raised, but likewise to some extent immediately round them, as well as by impeding the free course of the scythe: for these reasons the extermination of moles becomes an object of great consequence to grass-husbandry.

In the early spring months, when such hills are in a tolerably dry and powdery state, no time should be lost in spreading them out, and dispersing them in as even and regular manner as possible over the surface of the sward that adjoins them; as, when they remain long without being scaled, they do considerable injury to the grass plants underneath them, by blanching and rendering them tender. This business may be very conveniently performed by a common iron-toothed garden rake.

But it is invariably the best method never to suffer the animals to remain in the land, but to procure an expert mole catcher to destroy them, and thus wholly prevent the hills from being thrown up.

On the authority of an experienced mole-catcher in Nottinghamshire, the following method of destroying these animals is advised by a late writer: as moles have nests under ground for breeding and nursing their young, and passages communicating with them, wider and more frequented, and are more active in the spring months, beginning their work very early, his plan consisted first in attending their situations early, before sun-rise, as at that time he could frequently see the earth move over them, or the grass upon it; and with a small spade cut off their retreat by striking it into the ground behind them, and then digging them out. By laying the ear to newly raised mole-hills, the noise of the scratching was sometimes heard at a distance, so as to direct where to find them; from the solid earth conveying slight vibrations of sound better and to a greater distance than the light air. A terrier dog, after being accustomed to this business, was also often found of service, in de-



etecting, by his nose, the abode of the mole beneath the soil, showing it by beginning to scratch the earth above it. And from observing that they suckle four, five, and sometimes six young ones, their nests were dug up, having first intercepted the passage between them and the mole-hills in their vicinity to cut off their retreat. Another important circumstance is to discover which are the frequented passages, for the purpose of setting subterraneous traps; this is effected by making a mark on every new mole hill by a light pressure of the foot, and on the morning by observing whether a mole has again passed that way and obliterated the foot-mark; and this is to be done two or three successive mornings. These foot-marks should not be deeply impressed, lest it should alarm the animal on their return, and they should form a new branch of road, rather than open the obstructed one: the traps are then to be set in the frequented passages, so as nicely to fit the divided canal. They consist of a hollow semicylinder of wood with grooved rings at each end of it, in which are placed two nooses of horse-hair, one at each end, fastened loosely by a peg in the centre, and stretched above ground by a bent stick: when the mole has passed half way through one of the nooses and removed the central peg in his progression, the bent stick rises by its elasticity and strangulates the animal. As it was found that where the soil was too moist or tenacious, the moles in passing the old runs sometimes pushed a little of it before them, and thus loosened the central peg before they were in the noose, the peg in such cases was fixed a little faster in the middle of the trap. This method was pursued with great success.

It has been observed that by the use of the sward-dressing machine mentioned above, moss is not only torn up, but ant and mole hills levelled and destroyed, and the roots of grass plants cut and horse hoed, which causes them to throw out fresh lateral shoots or stems; by which the sward is thickened, and the surface rendered so clean as to have the appearance of a perpetual spring, when kept close fed down.

*Manuring Hay Lands.*—In order to preserve meadow and hay lands in the most suitable condition for the production of plentiful crops of grass, as well as to alter and improve the nature of the herbage, the occasional application of manure becomes necessary; as by this means the staple and depth of vegetable mould are not only much increased; but the land brought into such a state of fertility as that it may afterwards be kept up with much less expense and trouble. It is a circumstance well known to grass farmers in the best cultivated districts, that when lands of this sort are suffered to get much out of condition, it is a much more difficult business to restore them to the proper state of productiveness, than to preserve them in it. From the constant decomposition and decay of various vegetable materials on the surface of grass lands, new portions of vegetable mould are constantly added; that improve the quality of the lands, and at the same time afford a more suitable and fertile bed for the establishment of the different kinds of grass plants. It is chiefly, perhaps, on these accounts that old grass lands are super-



rior to new ones, and it explains the reason of the greater utility of earthy composts with dung in the latter than the former case.

In situations that will, from the natural dryness and composition of the soils, admit of the practice of applying the manure in the early spring months, there will be less risk of waste in these ways, and at the same time more advantage obtained in the growth of the produce; as from the moderate heat and quickness of the vegetation at this season the grass will soon cover over and conceal the dung, when applied in a proper state of reduction, without suffering much exhalation to take place; and the enriching material be conveyed to the roots of the grass plants at the season in which it can be the most useful in promoting their growth. Where quantity of produce is the principal object, and the nature of the soil will admit of the manure's being applied without injury, this is therefore unquestionably the most proper as well as most beneficial time of putting the dung upon grass lands. The earlier, however, it can be performed in the season the better, as has been already more fully explained.

An agriculturist of much experience and observation has, however, found manure to produce the strongest effects upon the land when applied early in the autumn, or in meadows as soon as possible after they have had the hay taken off from them. Others, likewise, suppose this last as the most proper season for the business:

The proportion of manure that is necessary must in a great measure depend upon the circumstances of the land, and the facility of procuring it. It should in general be such as to afford a good covering to the whole surface of the ground. In this district, where the manure is of a very good and enriching quality from its being produced in stables and other places where animals are highly fed, the quantity is usually from four or five to six or seven loads on the acre, such as are drawn by three or four horses in their return from town on taking up the hay. But where the manure is of inferior quality, there may be a necessity for a much larger proportion\*.

In regard to the frequency of dressing grass lands, it must obviously depend upon a variety of other circumstances, as well as that of the convenience of the farmer, and the means he has of providing it. But so far as it respects the soil, it should on the principles laid down above, constantly be performed at such distances of time, as that the fertility and condition of the land may not be suffered to decline, but be kept up and preserved in an equal or increased state of heart. In this intention the manner and frequency of cutting, or otherwise consuming the produce, must be attended to; as, where crops are more frequently taken off, the land must be prevented from being injured, by the great loss of fertility that must arise in this way, by the dressings being applied at shorter intervals, or in larger proportions at a time.

On meadow or grass lands that are in a proper state of cultivation, its being applied every third year may be sufficient; but on such as are of inferior value, every second year may be a better prac-



tice, as the lands by this frequent application of manure may attain a gradual improvement; whereas, in the other case, they would be on the decline, and in time to become poor and exhausted.

It is a too common practice, in districts where grass husbandry is imperfectly understood, to almost wholly neglect the manuring of their sward lands, in order to employ it on those that are under the plough; but this is evidently a bad and disadvantageous method for the cultivator; as it is only by the raising of abundant crops of grass for the purpose of being converted into hay, and of suitable kinds of green crops for green food; that an abundant stock of cattle can be kept, and the largest proportions of manure supplied.

There are some substances employed in the way of manure, as top dressings to grass lands, that cannot be frequently repeated with either safety or advantage. Chalk, marle, chopped woollen rags, and some other similar materials, are of this kind. The first of these kinds, especially when of a soft unctuous nature, so as to readily fall down in the state of solution to the roots of the grass plants, is found to produce the most beneficial effects, in rendering the lands more fertile and productive, and improving the quality of the herbage. It cannot, however, be often repeated in its simple state with advantage, as it is some time in producing its full effects; but in that of compost it may be applied with success at shorter intervals. Marle is likewise a substance, especially when it is of the rich soapy kind, that may be made use of with much advantage as a top-dressing on grass lands; but as its operation is slow it cannot be repeated at short intervals, except when employed in the state of a compost with dung. Woollen rags, when rendered small by being chopped into pieces, may be laid on land in the state of sward; but as they require a considerable length of time to sink down and become mixed with the soil, so as to be well covered by the grass, they cannot be repeated at short intervals. After they have been fully incorporated with the land, their beneficial effects are considerable, as have been shown by the trials of different cultivators.

There are several other materials that are occasionally used as top-dressings on grass lands; such as lime in combination with rich vegetable earth and with peat, the ashes derived from the combustion of peaty substances, coal-ashes, and soot. All these have been made use of with good effects when thinly spread out over the surface swards of lands in the state of grass, as has been already sufficiently shown\*. The three last have been found to produce the best effects in being dispersed over the new leys of the artificial grass kinds. All applications of this sort should be applied about the beginning of March, being spread over the surface as evenly as possible. If it can be done before a shower of rain it will be the better, as it is of advantage to have them carried down to the roots of the grasses as soon as possible after they are laid upon the land.

In the putting of manure upon lands of this sort, some attention is necessary not to suffer too much to be placed out in any of the

\* Section on Manures and After-management of new Leys.



heaps, but to have them set out as much as possible in not too large equal proportions, and at regular distances from heap to heap: as, where the contrary is the case, it not only takes up more time, and causes much more trouble to the labourer in spreading them, but does not admit of the work being performed in so regular or so exact a manner. Besides, when the heaps are set out too large, more injury is done to the grass plants on the surface where they stood, if not soon spread out; which should always be the case. The carts employed in many districts for setting out dung in heaps are by no means convenient for the purpose. In this neighbourhood this sort of business is far from being well executed, except where small carts are in use. From the large ones commonly made use of, the heaps are apt to be set out not only very unequal in size, but much too large, and there is considerable trouble in conducting the work. In many other districts, carts for the purpose are in general use, and constructed so as to render the labour more easy and convenient.

A very ingenious contrivance to facilitate the unloading of carts filled with dung or other sorts of manure; is mentioned by the author of the Perthshire Agricultural Report, as in use by Mr. McDonald. This improvement consists in the box of the cart being suspended at different heights; but can only be employed with advantage in carts constructed on a moveable frame, or what are usually called *coup-carts*, and where the load is to be discharged in several portions or heaps. A thin piece of iron of about two inches in breadth being fixed on the fore part of the box of the cart, exactly in the middle, extending in length to the top of the box, in which are inserted three or four oblong holes, in size corresponding to a rod, which is fixed with a staple in the middle of the first bar that keeps the shafts together; the length of this rod is about eighteen inches, or longer if necessary, as the height or length of that part of the box resting on the frame may require. The top of the rod is formed into the shape of a crescent an inch wide, with the points upwards, which corresponds with the holes in the plate. When the rod is not in use, it is made to rest on a hook in the front of the box, to prevent its dangling. When the driver wishes to unload his cart, he raises the box, putting the rod into the first nick, and makes the first heap; and moves on to the place where he intends to put down the second, again raising the box to the second nick, and so on till the whole is discharged.

In the spreading out of all sorts of materials on the surface of grass lands, it is necessary to see that the business be performed in an exact and even manner, and that all the clods and lumps be well broken down and perfectly reduced by beating with the fork or shovel. If possible, a dry season should be chosen for this sort of work, as, under such circumstances, it can be executed in the most regular and exact method. When the weather is wet it is an operation that can never be well performed, as the materials clog round the feet and tools of the workman, and can never be effectually separated or divided so as to spread with the necessary degree of evenness. After the heaps have been set out, they should not be suffered to remain so long, as is often the case, before they are spread, as



the plants underneath them become blanched and tender, and great injury is done to the sward in such cases, all of which may be easily avoided by spreading as soon as possible after the manure is taken out. Inconveniences of this sort may likewise be avoided by spreading the manure from the carts, as is the practice in the midland and some other districts; but in this method we suspect the work can neither be executed in so exact a manner, or with so much economy of time to the labourer. In this way hill-steads will not however be formed, and, of course, the disadvantage of their getting too large a proportion of the manure be prevented.

*Bush-harrowing.*—When the whole has been spread out, and remained in that state for a fortnight or three weeks, or longer, according to circumstances, and the whole is become in some degree dry and pulverisable, a bush-harrow should be passed over the surface once or twice in a place, as may be necessary, in order to reduce the manure into a finer state, and apply it more fully to the roots of the grasses. This operation, like that of spreading, should never be attempted when the season is wet and the manure in a cloggy adhesive state. When this work has been finished, all the rubbish of every kind should be carefully picked off, in order that the ground may receive the impression of the roller.

*Rolling Grass-Land.*—This is a process that is of considerable utility in the management of grass lands, especially such as are under the scythe, as without it they are often liable to become hilly and uneven, as well as the grass in some cases to become tussocky, or rise in large tufts. The impression of the roller not only renders the surface more fine and level, but at the same time induces the grass plants to spread more laterally, and in that way to form a better and more close sward. Its importance on new laid down grass lands is therefore extremely obvious: as it must be highly serviceable in these different intentions. The worm-casts are by this means reduced and brought into order, by which means the mowing can be performed with greater facility and in a closer manner. Besides, it may be useful in other views, as by pressing the mould, as well as the manure, more closely round the roots of the grass plants; and in consequence of such means they may not only be better established in the soil, and their vigorous growth more effectually promoted, but, from the moisture being more fully preserved in the ground, be in less danger of injury from the effects of heat in the summer months, and of course better crops be afforded.

On grass land the work of rolling may be advantageously performed at different seasons, as at the beginning of the autumn and in the very early spring months: but the latter is the most common period. But in order to its being executed with the greatest possible benefit, a time should always be chosen, if possible, when the ground is in a suitable state for receiving the impression of the implement. In the drier descriptions of land it may frequently be performed in the most beneficial manner after the land has been rendered a little soft by a moderate fall of rain; but in those of the contrary sort it may be necessary to wait till the superabundant moisture be so much dried up



as to admit the animals employed in drawing the machine without poaching, or otherwise injuring the surface of the ground.

A roller of considerable weight is necessary in performing this business in the most complete and effectual manner, such as has been already described\*. And in order to prevent as much as possible the ground from being injured by the feet of the animals that draw it, as may frequently be the case where they follow each other in the same track: it may be the best practice to have them yoked double, as by that means there will be less treading on the same portion of service. Where two horses are sufficient to execute the work, more should never be made use of; but if a third should be found necessary, it may be attached as a leader in the middle before the other two: a greater number of horses can seldom or ever be of any material advantage in this sort of work. It is necessary to be very careful in executing this operation, to see that every part receives the due impression of the implement. On lands where this sort of work is regularly performed, it will seldom be requisite to pass more than once in a place, but in other cases it may often be done more frequently with benefit.

The rolling of watered meadows should be executed towards the latter end of February or beginning of the following month, after the land has been left in a dry state for a week or ten days. The work should be performed lengthways of the panes, going up one side of the trenches and down the other. And in rolling the common hay lands, it is a good method to proceed up one side the field and down the other somewhat in the same manner.

As grass lands, especially those that have not been long restored to the state of sward, are sometimes liable to become thin and patchy, it may be necessary to restore or bring them to a perfect condition of surface, by sowing fresh grass seeds over the patches or uncovered parts. This is best performed as early as possible in the spring season, during moist weather, the seeds being either left to themselves, or trodden in by folding sheep thinly upon them. The roller may likewise be useful in this view by being run over the patches, though not so effectual as that of sheep. In this, as well as other cases, such sorts of grass seeds should be chosen as are the most adapted to the nature of the lands. The methods of managing this sort of business in the best manner have been shown above. The utility of scarifying, or cutting the surface of grass lands by harrows or other implements set with coulters, has also been considered, but too few experiments have yet been made to form any decided opinion upon the subject.

*Watered meadows.*—There are frequently extensive tracts of grass land, that from the nature of their situations are capable of being covered occasionally with water from the rivers, brooks, or small streams, that flow through or near to them, and in this way admit of being improved and kept in a constant state of fertility and productiveness, without the trouble or expense of other sorts of manure.

\* Section on Implements.



Fig. 1.

GRAND CARRIERS

Diagonal system of watering  
 1<sup>st</sup> 13, 14, 15, 16, 17  
 2<sup>d</sup> 18, 19, 20  
 3<sup>d</sup> 21, 22  
 4<sup>th</sup> 23, 24  
 5<sup>th</sup> 25, 26, 27  
 6<sup>th</sup> 28, 29  
 7<sup>th</sup> 28, 29  
 8<sup>th</sup> 30, 31  
 32, 33 separately



Fig. 2.

WATERFALL & MEADOW



Fig. 3.



Form of ridge for Flat Lands

Water from main carrier  
 let into ditch trench 32 & stop 33  
 let down runs over division 1 trench 34,  
 acting as a drain, conveyed to trench 35, & stop 36,  
 let down division 2 is over-flowed, & conveyed to 3, 4 & 5 the step down up & 37 let  
 down, divisions 6, 7, 8, & 9 are watered, & in the same manner by steps 38 & 39 which  
 water divisions 10, 11, 12, also 13, 14 & stop 40 let down, & 41  
 down the water flows into the trench 34 & stop 44 being let down division 15 is wa-  
 tered & by trench 45, successively divisions 16, 17, 18 & 19. Consequently when  
 trench 46 is supplied & 34 & 35 are empty divisions 1 & 15 are in a perfect state  
 of drainage which shows the system







The greatest improvements in this way are effected, and the expenses of performing them the least, in those places where the current or descent of the streams is the most rapid.

The most suitable soils for being watered are those that are of a sandy or gravelly friable nature, as the improvement is not only immediate, but the effects more powerful than on other sorts of lands. Some strong adhesive sour wet lands, such as are common in the vicinity of large rivers, are also capable of being improved by watering; but the beneficial effects are not in these cases so soon produced as on those of the above kind, nor is the process so advantageous to the farmer, on account of the very heavy expense to which he must, in many cases, be put by previous draining. Such lands as contain coarse vegetable productions, such as heath, ling, or rushes, may also be greatly improved in this way. There is another circumstance in regard to the different soils that may be benefited by irrigation, which is, that the more tenacious the soil is, the greater the command of water ought to be.

A stream capable of watering fifteen or twenty acres of light dry land, would be found to be beneficial in but a small degree if applied to watering half the same extent of cold clay soils, such as in their natural state abound with rushes. All soils of the last sort require a considerable body of water for the purpose of floating them, in order to produce much effect. If this cannot therefore be procured, such means of improvement will seldom answer the farmer's expectation, or turn out to much account.

Those grounds which admit of being benefited in this way with the most success are such as lie in low situations, on the borders of streams or rivers, or in sloping directions on the sides of hills, to which water can be conducted in the manner directed below.

It is necessary, before entering upon works of this kind, to consider, whether the stream of water to be employed will admit of a temporary wear or dam to be made across it, so as to keep the water up to a proper level for covering the land without flooding or injuring other adjoining grounds; or if the water be in its natural state sufficiently high without a wear or dam, or to be made so by taking it from the stream higher up more towards its source, and by keeping up the conductor nearly to its level till it comes upon the meadow or other ground. Further, if the water can be drawn off the meadow or other ground as rapidly as it is brought on. Besides these, having attended with care to all such other difficulties and obstructions as may present themselves, from the lands being in lease through which it may be necessary to cut or form the *mains* or *grand carriers*, from the water being necessary for turning mills, from the rivers or brooks not being wholly at the command of the irrigator, and from small necks of land intervening, so as to prevent the work from being performed to the greatest advantage, the operator may be in a situation to commence the business of irrigation.

This is to be done by the use of a *spirit level*, beginning from the highest part of the land that the stream can be commanded from, where the grounds on the different sides are the property of the same person, and wears or other works, as has been just observed,



can be carried across the streams for the purpose of forcing the water, either wholly or in a partial manner, into a different course. After it has been raised as high as possible in this way, the level is to be formed from the surface of the water, carrying it on what is termed the *dead level*, and marking it out, at certain distances, by two rows of sticks or stakes well driven down, one on the line of the dead level and the other opposite to it, at such distances below as may be sufficient to allow for the proper flowing of the water: a few inches in the mile will be sufficient to draw it, but from a foot to a foot and a half or two feet in that length may be requisite to afford a proper fall; and where interruptions present themselves from buildings or other causes, a still greater fall will be necessary, in order that the passing of them may be provided for in a gradual, not a sudden, manner. It is proper to proceed in this way to the extent of the land that is capable of being watered. And when necessary, the level on the land upon the other side of the stream may be set out in a similar manner.

After this has been done, the land on the different sides of the stream, below the lines set out by the level, should be minutely examined and inspected, as the whole may be irrigated if the command of water be sufficient. The extent that can be properly performed must, however, depend much on the degree of fall or descent from the entrance of the water and its out fall, as well as on the declination of the more elevated parts of the ground. It, however, generally happens that a much greater space of land can be covered with water than was at first supposed.

The next circumstance of importance is that of deciding where to commence the business. This must depend on various points, which can only be settled by the judgment of the operator. If there be a full supply of water, the whole should be covered; but in the contrary case, the expense of cutting the mains or carriers on such levels in a sufficient manner should be considered; and where one side of the stream is better adapted to the purpose than the other, that on such side should be the first executed. And if the land most adapted to the purpose of watering be at much distance from the place whence the water is first taken, and there is not a supply for the whole of the land below the line of level on one of the sides, the expense of forming the carrier should be put in comparison with the greater advantage of irrigating the most suitable grounds, in preference to others that are nearer, without possessing equal advantages. It mostly happens that the beneficial consequences of irrigating at command are such as to overbalance that of forming the mains or carriers. Besides, though the supply of water may be insufficient in such seasons as are very dry, as it may be abundant in the winter time, the simply covering the land at that period may be more than adequate to the expense of the business; which is a circumstance that may render it more beneficial to lengthen the carriers, than by having them shorter to be confined to the watering of such lands as are less proper for the purpose. It is probable also, that in particular cases the winter irrigation may extend through the whole of the level that has been set out.



Where it may happen that there are a great variety of different sorts of land below the line of level, such as low, flat, wet meadows, extended on the borders of the river, having pastures with dry, gravelly, or sandy tillage lands higher up, and moory or heathy grounds, so that the operator has it in his power to perform the business, at his option, on different sorts of land, it is too frequently the case to begin with the low grounds that admit of improvement in other ways; as by draining and proper manures of the fossil kind, and that are not only the most difficult and expensive in the execution, but often the least advantageous in the produce afterwards, except when the business is performed with uncommon correctness. Therefore, in examining such grounds as are situated below the mains or carriers, the irrigator should fix upon such lands as are, from the nature and condition of the soils and the smallness of their value, capable of affording the greatest and most speedy improvement and advantage. In most cases these will be found to be the more dry declining parts in the state of tillage, and the old worn out dry pastures. And in some instances the heathy and moory lands may be selected for this purpose with great chance of benefit.

Where it can be done, it is best to begin with such parts as are contiguous to, or approach the nearest, the mains or carriers; and, after having passed the water over them, to mark the lowest places, where it can be carried off to the best advantage; and from such parts it should then be seen to which other lands the water can be conducted with the greatest facility and benefit. Where the natural shelving of the ground is considerable, less care is necessary; but where this is not much, it may often be requisite to convey the water in a slanting direction for a considerable way, before lands sufficiently low for being covered by it are met with; as in this sort of business it is invariably necessary, in order to prevent the waste of water, to proceed with that which is first made use of to its final outlet into the river before the works on other divisions are commenced.

On extensive sloping tracts of land managed in this way, it of course mostly becomes necessary to convey the water in a slanting direction across them. And an opportunity is thereby afforded of throwing it over the lands in the intermediate space, between the bed of the river and the *master drains or carriers*, and in this way one space or division of ground may be supplied after another, and the water conducted at pleasure to any given point, thereby enabling the operator to supply or omit any space of field that he may think proper, but still by this means preserving the regularity of the plan, which at any future period may be perfected.

In this view the most material circumstances to be attended to are the abundant supply of water and the quickness of its being conveyed off, as by its sluggishness or stagnation much mischief may ensue.

It is an advantage in this oblique or slanting method of watering, that it may be performed to advantage with a *smaller supply* of water than in others; as where that is the case it may be directed to



such spaces only as it will be equal to, but when more abundant, it may be suffered to overflow the whole at the same moment.

And it is too frequently the case that the trenches and drains are so injudiciously made as to take off the water without the possibility of using it a second time; and there are other instances of its being conveyed into slopes without any care of its future course, thereby producing great inequalities in its consequent effects. These points should, therefore, be constantly attended to, and avoided as much as possible.

When the piece of ground to be floated is so much upon the level that the descent cannot easily be determined by the eye, it will be necessary to take an accurate level, and compare the highest part with the stream intended to be used, by which the degree of fall from the surface of the water to the highest point of the land will be ascertained: and in order to convey the water to this point, should it be distant from the stream, the sides of the ditch or canal should be sufficiently raised for the purpose not to keep the water in a dead level, but with such degree of descent as the two points will admit of. In the operation of cutting this canal or main feeder, it will be easy to preserve the proper degree of fall, having previously ascertained the length; for instance, in cutting fifty yards with a fall of five inches, it will be obvious that in every ten yards a descent of one inch should take place: this is necessary to keep the water in a constant lively motion. In some cases it may be necessary to have two main feeders, in order to effect a more equal distribution of the water; the depth and width of which feeders must be regulated by the supply requisite for the small gutters. Near to the mouth of the canal or feeder, it will be proper to have a flood-hatch, or *clow*, by which the water may be admitted or excluded at pleasure.

In forming the floating gutters, it is perhaps the best method to cut them at right angles to the feeders; however, where the surface is uneven, in order to preserve a regular descent, a different direction must be given to them, the distance from each other being about ten yards, and the gutters becoming, as has been observed, gradually narrower as they recede from the main canal or feeder. The object in view being to throw the water as evenly over the surface as possible, these gutters should be so constructed that the water which has been introduced may overflow their little banks rather than run rapidly along the bed. Obstructions may sometimes occur, such as low parts, or deep ditches, over which a pipe or spout may easily be made to continue the progress of the water; and such as proceed from ridges, roads, or small eminences, by trunks or other contrivances made to convey the water underneath them.

The necessary preparation for the introduction and spreading of the water being made, it will be proper to form drains to receive and carry off the water in nearly the same proportion that it has been introduced; which is to be done by drains, running parallel to the gutters at even distances from each, or, as the irregularity of the meadow requires, being made narrowest at the highest part, increasing in width as they approach the lowest (which is the reverse of



the preceding works), until they arrive at the main channel that takes off the water that has been collected.

On the completion of these works, when the water is first introduced, it may, perhaps, be found that it will not spread itself evenly: this may be regulated by stops across the feeders or floating gutters, at such places or distances as the operator may find necessary: these stops may be made by putting down a stake at each side of the water and placing a board before them, thereby raising the water to such heights as may be required.

In the Plate annexed, at *fig. 1*, is explained the method of watering in an oblique direction over the space between the grand carrier and bed of the river, as described by Mr. Young. In which “1 is the river; 2 the grand carrier; 3 the field first watered; 4 the field watered after the first; 5 and 6 ditto in succession; 7, 9, the *prise d'eau*; 8 a sluice to throw the water into the field where first used; 10 final exit of the water. But in this respect the variations may be as many as the forms which a tract of country presents, 6 may be a good meadow already: in that case the water may run to waste in the ditch 11, and so find its way to the river.”

Thus, “the divisions 13, 14, 15, 16, 17, form a diagonal system. The others, 18, 19, and 20, another: 21 and 22, another: 23 and 24 another: 25, 26, and 27, another: 28 and 29, 30 and 31, others: 32 and 33, by themselves, the one from the carrier, the other from the ditch between it and 28.”

*Fig. 2.* Represents a watered meadow as described by Mr. Young, where the slope from A to B is regular, but which is not material to the business. In this case, if “the water from the main carrier, river, or ditch, 31, be let into the delivering trench 32, and the stop 33 be let down, the water will flow over the pane or division of the meadow 1. The delivering trench 34 then acts as a drain, and conducts the water into the trench 35, the stop 36 being let down; thence, of course, it overflows the pane, No. 2, and in like manner, successively, No. 3, 4, and 5. If the stop 33 be drawn up, and the stop 37 let down, the panes 6, 7, 8 and 9, are watered in the same way; and so on by the stops 38 and 39, which will water the panes 10, 11, and 12; also 13 and 14: and the stop 40 being let down, and 41 drawn up, the pane 30 will be watered. Then returning to the ditch at the other end of the field, and letting down the stops 42 and 43, the water will flow into the trench 34, and the stop 44 being down, the pane 15 is watered, and the trench 45 becomes a drain, which, successively, conducts the water, as above explained, over the panes 16, 17, 18, and 19. And when the trench 46 becomes supplied with water, and the trenches 34 and 45 are empty, the panes 1 and 15 are in a perfect state of drainage: which sufficiently explains the system, and shows how every trench operates, either for delivering or draining off the water, at the pleasure of the irrigator.”

Some advise, that when the lands are quite level, or nearly so, ridges of about eleven yards wide should be formed by the plough, and raised about three feet on the crowns; it will be of course necessary to use the spirit level in their formation, as well as in that of



the top trenches for receiving the water from the *main carriers*; and that the drains on the sides may be properly constructed to convey it to the ditches. The trenches should be cut in a direction verging nearly to a point, in order to give an equal overflow of water the whole length: but where the land is sloping, trenches alone will be sufficient, causing an overflow in each direction.

It is further necessary, in attempting to improve meadows or other lands by the application of water, to ascertain that both the soil and subsoil are naturally dry, or have been made so by open or under drains, otherwise they cannot be benefited by watering, as has been found from much experience. Of course the previous operation of draining is indispensably necessary, before lands in which there is much moisture can be flooded with any probability of success. The perfection of watered meadows consisting in the operator's having it in his power to let on or take off the water at pleasure, it follows, of course, that a complete power of drainage is as requisite as the command of water.

The length of time which meadows should remain floated, and the necessary repetitions of the floating, must obviously depend on various circumstances: but as after every watering the floater should be extremely careful to drain off the water from every part of the land, and as the most prejudicial consequences are known to result from any degree of neglect of this kind, it would be an useless expense to prepare a field for being floated, unless previously ascertained that it possesses sufficient declivity for carrying off the water when its continuance may be attended with injurious effects. In forming meadows of this kind, the drains that are to carry off the water when no longer necessary, should therefore be as carefully attended to as those by which the water is to be brought on.

In short, it may be observed, that this operation, as has been already shown, may be applied with utility to all those low-lying lands, that are capable of being overflowed directly from the rivers or streams that adjoin them, or on which considerable proportions of water may be brought by a cut from a river at a higher level than the surface of the meadows, or the tops of the ridges; if such preparation for watering has been made, the water being so conducted to the nearest part of the meadow, it is there branched out, by a number of smaller cuts, made for the purpose. These cuts being filled with water, forced into them with as much rapidity as possible from the main cut, overflow their banks, and a general flooding ensues over the whole meadow if sufficient water be procured.

Where watered meadows are ridged up, drains are made in each furrow to receive the water which overflows the little cuts that are made on the tops of the ridges, and, falling into the drains in the furrows, runs off into the tail drain, and which may be used to water some adjoining field, or reconducted to the river; so that when the drains are properly formed, by stopping the inlet the field may be immediately laid dry. This is most expeditiously done where cross drains are made from those on the tops of ridges, so that the water is conducted into the drains in the furrows, as soon as the main drain is shut. On meadows whose surfaces are irregular, and where an



abundance of water cannot be procured, the cuts necessary to flood it can only be determined by the skill of the operator.

There is another description of watering, usually denominated *Catch-work*, which is applicable to such meadows, grass and pasture lands as are situated on the sides of hills, and capable of being watered by conducting the water of some stream round the edges of the hills. The method of watering such lands differs from the former, as fewer cuts are necessary, and these as nearly in parallel lines below each other as the bank will permit: the water by the main-cut having arrived at the top of the piece of ground, it begins to run over, overspreading all the surface in its course, and falling into the cut immediately below it, which, becoming full, discharges itself in the same manner into the next, and so on, till at last the water arrives at the bottom of the field, and falls into a drain made for the purpose of carrying it away, or conducting it to other grounds on lower levels.

And at Fig. 1, in the plate which is annexed, A, A, represents the river running through lands. B, B, two mains drawn at right angles with the river, one running north, the other south, across the meadow to within about six yards of the fences. C, C, fence ditches at the head of the meadow, used for tail-drains to convey the water that runs over the way-panes, I, I, watered from the upper side of the mains, B, B, by these fence-ditches the water is conveyed into the side fence-ditches, H, H, to the tail-drains, or lower-fence ditches, G, G, and discharged by them into the river A again at K. D, a wear erected across the river to force the water into either of the mains, B, B, which is done by shutting the wear D close. L, L, two wears erected at the mouth of each of the mains, B, B; their uses are, when the wear D is shut close, and there is not water enough, or it is not convenient to water both parts of the meadow at once, by shutting close one of these the current is forced into that main whose wear is opened, thence to be conveyed through the trenches over the panes, to water that side of the meadow; then by shutting that, and opening the other, the opposite main, B, is filled, and by means of the trenches that side of the meadow is watered in the same manner; and lastly, by shutting them both, and opening the wear D, the water flows in its usual course, and the land on both sides is laid dry. E, E, E, E, trenches taken out of the mains B, B, to convey the water over. M, M, M, M, M, M, M, M, which are the panes or parts of the meadow that produce the grass. F, F, are trench-drains to draw off the water from the panes and convey it into the tail-drains. G, G, the west fences of the meadow, here used for tail-drains to convey the water into the river. K, the place where they discharge themselves into the river. N, N, two drain sluices, one at the lower end of each main, used when the wears, L, L, are either or both of them shut close; these drain sluices are opened to convey the leaking out of the mains into the fence drains, H, H, to keep the land dry and healthy. I, I, are the way (or road) panes, watered from the banks of the mains B, B, the whole length of the mains.

Fig. 2. A, the river. B, a wear erected across the river. C, the



head main taken out of the river above the wear B. S, a wear erected across the main C, to be kept close when the meadow is not watered. D, a smaller main, taken out of the head main C. E, E, E, E, bends made in the small mains, and trenches just below the places where the branch-trenches are taken out of them, to check the water at those places, and force a proper quantity into branch trenches. G, G, G, G, G, G, bends made in those branch-trenches which have so much descent that, were it not for these bends, the water would run down almost to the end of the trenches before it would flow over the panes. H, H, H, H, H, H, H, H, H, H, trench-drains to convey the water off from the panes. There should be one on each side of every trench, unless a fence-ditch, or the river, can be used instead. P, P, sluice-drains, to convey the leaking of the water out of the mains D, and F. L, L, L, L, trenches taken out of the small mains, to convey the water into the various parts of the meadow, which at the lower part increases in width. T, T, T, T, T, branch-trenches, taken out of the other trenches. N, N, N, N, N, N, N, N, N, various gutters taken out of the ends of some of the trenches, to carry the water to the longest corner of the panes, and sometimes taken out of different parts of the trenches, to water some little irregularities in the panes, which without such assistance would not have any water upon them. I, a master or considerable drain, into which several others empty themselves, and thence run into the tail-drain. K, a sluice, erected at the end of the small main D, to force the water into the branch trench T, that being the highest ground. M, the tail-drain, which receives all the waters from the other drains, and conveys it into the river at O, the point where the water from the tail-drain runs into the river. R, a fence ditch, being the bounds of the meadow on that side, and used also as a drain to convey the water into the tail-drain.

*Fig. 3.* A, the head main, taken out of the river, forming an angle of about sixty degrees. The descent of the land permits the main to overflow it at B, the point where the meadow can be watered, consequently the place for the main B, B, to be drawn, at right angles with the stream, the whole breadth of the meadow intended to be watered, excepting about five yards at each end. C, D, two wears erected to turn the water either way; or, when both are shut, to keep it in its proper current. E, another wear for the purpose of dividing the meadow into turns. F, G, H, I, K, L, A, D, sluices to convey the water into, or stop it out of the trenches, as found necessary. M, N, two drain sluices. O, P, Q, R, S, T, V, W, bends to stop the water in those trenches which have the quickest descent. X, Y, Z, a, b, c, d, e, f, g, h, i, k, gutters to carry the water to the ends of the panes, and little irregular parts in the meadow. C, C, the lowest part of the meadow, where water is conveyed away. From the main B B, to the principal drain A B, the meadow is watered regularly; but betwixt that drain A B and the small main A C, there is a great flat. To fill it up would be the regular method, so that the trenches taken out of the main B B should go down to the end of the meadow; to avoid that expense, the end of the main B B is continued down to the east side of the meadow,



till it has passed the flat grounds to F. Materials being had from the drains, &c. to raise the ground high enough to convey the water in the main on to F, which being the high ground, it is then carried east and west, the same as the main B B. Trenches are taken out of it, to water the lower part of the meadow. Trenches are also drawn out of the main that runs north and south, to water the flat part the opposite way; with drains between them to carry off the water into the west fence ditch. At E a wear is built to stop the water, and turn it into the trenches above it: at F a sluice is placed to turn the water into the main A C. For the same reason, the sluices A D and K are set at the mouths of these trenches to force the water down to the lower divisions of the meadow. The trench-drains A E and A F convey the water from the upper pane of the main A C, and also from one of the cross trenches A H. And A F and A B do the same from the other cross trench A G. To water this meadow it will be necessary to divide it into two, or perhaps three turns, if water should be scarce. One turn will be made by opening the wear C, and shutting that at D; the sluices G and H being also opened, the water will flow over the lower side of the main B B from D to M, down all those trenches that are taken out of it; and will be carried off from the trench-drains by the principal drain A B to C C. Thus will that part of the meadow be watered. Another turn is made by shutting the wear C, opening D, and shutting E. The sluice H being stopped, and the sluices I, A D and K opened, that division of meadow from the wear D to E will be watered, and the panes on each side of the main B B also, by the water flowing over its banks as it passes along; which is carried off on the one side by the river, on the other by the principal drain A B; and also from the panes on each side of the trenches A G and A H by the same drains A B, and the trench-drains A F and A E into the west fence drain to C C. The other turn is made by shutting the sluices I, A D and K, opening the wear E, and so much of the sluices F and L, as will let water enough through to supply the trenches below them; keeping that at F partly in, to turn the water into A C, and that at L the same also, partly to check the water, and force it over the sides of the small main A C, and into the trenches, 1, 2, 3, 4. The reason for putting the sluice across the small main A C at L is, that part is supposed to be flat ground from L quite to C C; consequently the water would, if not prevented, run so fast down to the ends of the trenches, 5, 6, as to draw all off from the high grounds, from L upwards. The small main A C is too wide to be checked by a bend at that place; besides, it would not answer so well to regulate the quantity of water necessary to water the panes from L to C C; and it is on the account of those trenches 5, 6, that a sluice is built. The water which runs out of this meadow at C C is, if the descent is quick, immediately made use of to water the next meadow below, or if there should be but little descent, it is oftentimes considered as a head main; and wherever below it will rise over the land, it is again made use of, in the same manner as it was at first in this plan of watering.

In all cases where the watering system is undertaken, except in



the time of floods, it may be highly useful to disturb the mud and dirt in the bottom of the *main carriers* or drains before watering, a practice frequently adopted on the continent. Lime has also been thrown into these cuts by some irrigating farmers, and raked with a heavy harrow or other implement at the bottom, which is a process that will be found to add considerably to the manuring quality of the water. It is probable that many other substances might be employed in the same way, and be thus spread over the surface of grass lands in a minute state of division, with vast advantage in promoting vegetation.

There is another method which seems capable of affording advantage in this business, especially when the lands are not well set with grass plants, which is that of sowing them with suitable grass seeds before the process of watering is commenced; but in these cases the water should not be continued flowing too long at a time, as by that means the vegetative power of the seeds might be destroyed. A good sward might probably soon be formed in this way.

To form meadows in a proper manner for watering is attended in many cases with considerable expense, but varies, according to circumstances and the nature of the irrigation, from six to twenty pounds the acre. Catch-work meadows from three to seven, besides the annual expense of implements and labour. In order to overbalance so great an expenditure, great and permanent advantages should be the consequence. However, in some instances this does not prove to be the case, especially when the soil and the water are not both well adapted to the purpose. But, as such cases seldom occur, it may be generally said, that it is an important means of improvement, whether the object be hay or pasturage.

The great degree of verdure and luxuriance which almost immediately succeeds the occasional covering of grass lands with water, sufficiently demonstrates the power which it possesses in promoting vegetation. It is a means of fertility that has been employed for ages in more warm climates, with the most beneficial consequences in increasing the quantity of vegetable produce. But though it has been long in use in other countries, and of late more particularly attended to in this, the principal on which it produces its effects does not seem to be fully understood. In speaking of manure as the food of plants, we have already noticed some of the properties of this fluid that may be useful in the vegetable economy when taken up by the fibrous roots of plants, and there are still other ways in which it would seem to be advantageous in forwarding the growth of grass crops.

In climates where the heat is considerable it may be of much utility, not only by keeping the fine fibrous roots of the grass or other plants in a moist patulous state, the most proper for the purposes of absorption, but in such a temperature or state of heat, from the cooling effect produced by the constant evaporation that is taken place near the surface of the ground, as is the most suitable for their healthy and vigorous growth. It is probably in this way that garden plants are principally benefited by the application of water in the hot summer seasons in our own climate, as when the waterings are



not constantly kept up, injury rather than good is mostly experienced.

But another and more beneficial way in which grass produce may be immediately increased, and the fertility of the lands more permanently improved in this country by the floating or covering them with water, is from the waters of the rivers or brooks that are turned upon them, containing, either in the state of solution or diffusion, a variety of different sorts of enriching materials which they gradually and evenly deposit upon the surface while they rest upon or slowly flow over it. This must be the case in all those instances where the rivers or streamlets either arise in, or in their course flow through or over beds of chalk, marl, or other calcareous stata, as in their passage they become highly impregnated with the fine particles of these different substances. And where they are fed by the small runlets which receive the waters that proceed from the higher and more elevated lands, they must often, especially after heavy rain, be loaded with a large proportion of fine rich materials of the animal, vegetable or other kinds, which they deposit in a regular manner in their tardy trickling course over the surfaces of the fields.

But it would appear that waters thus impregnated produce the most beneficial effects, particularly when not in flood, upon the lands that are the nearest to the sources whence they become principally impregnated with their fertilizing principles; as when they have flowed to some distance they have, in a great measure, deposited and let fall such enriching substances, and are become too pure for affording advantage in the way of deposition. It is only in the time of floods that they can produce much utility in this way at any great distance. It was found by an able philosophical writer, that the water of the Darwent, though it flows for several miles, near Matlock, through calcareous stata, contained no impregnation of this sort on its reaching Derby, although the springs in that neighbourhood had a large proportion of it in their composition.

The same author has ingeniously suggested another mode in which water may prove serviceable in floating grounds in this climate, which is that of protecting the grass or other plants from the too severe effects of cold during the winter or early spring season. In this view it is observed, that the water of strong springs, which in this country have constantly the temperature of forty-eight degrees of Fahrenheit's thermometer, is to be preferred to that of rivers, where it can be procured in a sufficient proportion, as the degree of cold in these is in the same ratio with that of the atmosphere till it declines to the freezing point, or that of thirty-two. Though both when spread out, forming a thin sheet of ice on the surface of the land, are beneficial in defending the roots of the grass plants from too intense degrees of cold, and of thus preserving them in a more healthy condition; and it is added, that those of some sorts of grasses are supposed to even vegetate beneath the ice, as the rein-deer moss in Siberia vegetates beneath the snow, in a degree of heat of about forty, which is the medium between that of the inferior surface of the dissolving snow, or that of thirty-two, and that of the common heat of the internal parts of the earth, which is forty-eight, and in this manner,



the grass produce in this cold country be considerably increased, so as under proper management to nearly double the usual annual quantity under other circumstances.

In illustration of these principles it may be observed, that the water issuing from springs where they abound with the particles of gravel, or a slaty mouldering kind of rock, containing a large proportion of calcareous earth, are known from experience to be better adapted to the purpose than that which arises from others that do not contain such materials. The difference in the effects, often so visibly produced, has been accounted for, from watering one field from a spring issuing out of a chalky soil over those which take their rise in another, similar in every respect and management, except that the water applied arises in, or flows through, a swamp or morass, composed chiefly of peat earth, or proceeds from situations known to contain none of these substances.

The fact is unquestionably established, that the water of rivers which run through comparatively level and fertile countries is not only better than that of such as have their courses through mountainous unproductive tracts, but superior to all others, as every different streamlet adds a new accession of fertilizing materials, which, dispersed over the surface of the meadows in their fine and attenuated state, cannot avoid adding a considerable degree of improvement to the lands.

Winter and spring are the two seasons when meadows are usually watered, as from the month of November till the beginning of March: the experience of the operator can alone regulate this proceeding as to the length of time they should remain under water. In some districts the water is allowed to flow over the fields for several weeks together, with only the interval of a day or two occasionally; in others, the practice is to flood them the alternate weeks. When frosts set in floating is usually suspended; but it has been remarked, that in such cases the succeeding crop of grass has been abundant. As the spring advances, much less floating is found to be necessary. However, in all cases, when floating is performed to advantage, the meadows should be laid dry between every watering.

On the sandy, gravelly, and drier kinds of land, the water is directed not to remain so long at a time upon the land as in those of the heavier kinds. In the latter sorts Mr. Wright thinks three weeks long enough, but Mr. Boswell advises a month, or even six weeks, in the first waterings, about November; but a something shorter time for those of the former sort. In December and February Mr. Wright recommends the land to be let dry for the purpose of air for a few days, and in February particular attention is advised not to permit the water to flow over the ground many days together without being taken off, as there may be danger from white scum being formed; and if the land be left exposed to frost in its wet state it may be injured in that way. These different inconveniences, it is said, may be avoided by taking the water off in the day time, and turning it upon the lands during the night. Mr. Boswell does not, however, seem to apprehend any danger in this way.

About March there will mostly be a sufficient bite of grass to ad-



mit the lands being fed by stock: the water should, therefore, be turned off for a fortnight, to give it sufficient firmness before they are turned in. During the following month the grass may be eaten close, but not later; as continuing it even for a few days in May would greatly injure the hay produce which is to be obtained both in quantity and quality. In the month of May, after the grass has been fed down, the water should be again turned over the lands for a few days, by which the land is so moistened as to produce a full crop of hay. It is probable that with less close feeding two crops of hay might frequently be taken with advantage. The first crop of hay from watered meadows, when cut sufficiently early, is equally good with most other sorts, but when let stand too long becomes coarse and unfit for fodder.

It has been observed on this subject by a philosophical observer, that where the flooding of lands is continued some time, the water should only be suffered to trickle or flow over it gently from the higher parts, and not stagnate upon it; as in the latter case the grass roots are soon destroyed in the spring, and, that when such materials begin to decay underneath the water, a white scum arises in consequence of the air set at liberty by the beginning putrefaction, which has been suspected as prejudicial to the grass, but is rather the effect than the cause of the mischief, and demonstrates that the water has remained too long in a stagnant state upon the ground, and requires to be removed or to have a fresh supply from the stream; but the former is probably the better. The necessity of continuing the watering after it has been begun, in hot climates and seasons, has been already mentioned; and there may be injury done to the grass plants by the sudden application of much water under such circumstances of great heat.

The beneficial effects of watering meadows is obvious in producing an early and luxuriant vegetation, with proper soil and water, as appears by a comparison made by those who had an opportunity of seeing Mr. Bakewell's judicious application of this means of improvement on a piece of ground set apart for experiments in this branch of husbandry. If they had pursued their survey a little further, they might have discovered, that while the Dishley fields were covered with an almost perpetual verdure of the most nourishing grasses, those of the neighbouring farmers were famous only for the rushes and other weeds which they produced.

As the grass of watered meadows is very forward in March and April, they are generally pastured in the spring with sheep; and to those farmers who keep them for breeding or fattening, it becomes almost invaluable from the scarcity of green food at such times: after being flooded again in the latter end of April, they are shut during the summer for the hay crop. The after-grass is eaten off in autumn with cattle, it being considered as very pernicious for sheep to pasture on watered meadows. The Sussex Report records a remarkable instance of its fatal effects; "Eighty ewes, from Weyhill fair, were turned into some fields adjoining a watered meadow: a score of them broke into the meadow for a night, and were taken out in the morning and kept till lambing; they produced



twenty-two lambs, all of which lived, but every one of the ewes died rotten before May-day. The remaining sixty made themselves fat, nor could a rotten sheep be discovered amongst them."

That the grass of watered meadows should be so nourishing to sheep in the spring, and should prove so destructive to them in the autumn, is not easily accounted for; but the fact appears to be established beyond doubt. Mr. Boswell advises, that no sheep, except those that are just fat, should ever be suffered, even for an hour, in watered meadows, as they will infallibly rot them at any other season than the spring, especially if made from low, boggy, or swampy ground: "not so when made from dry healthy land."

On farms where it is convenient to have three or four meadows that can be watered, it will be found very advantageous; as while cattle are eating the first, the second will be growing, the third draining, and the fourth under water.

In Wiltshire watered meadows are of considerable advantage to the farmers, as they afford an early supply of grass for the forward or early breed of lambs, on which they begin to feed them about the middle of March, having previously withdrawn the water from the meadows and laid them as dry as possible. On a good crop of grass of this kind five hundred couples may be fed for one day on an acre. The practice is to hurdle out, daily, such a portion of the ground as is necessary, leaving a few open spaces in the hurdles through which the lambs may feed forward on the fresh grass. The hours they are suffered to feed on this grass are from about ten o'clock in the morning till five in the afternoon, when they are generally folded on the contiguous barley fallows.

This practice is supposed to have its advantages from its manuring a part of the farm without having recourse to the dunghill, as well as in affording a very early supply of food for the sheep at a season when green food is scarce, and in being ultimately useful to the other stock, affording much manure, and thereby enriching other lands. It is supposed to be an improvement that every farmer ought to adopt and encourage, where soil, water, and situation are favourable.

On the whole, there can be little doubt of the great advantage of this method of improving grass lands in situations where it can be conveniently made use of, and that it is capable of being applied in a much more extensive manner than has been hitherto the case; by the operators properly availing themselves of the occasional falls of rivers and small streams, as well as of canals, in some seasons, is not to be disputed, as by such means water may often be distributed over vast tracts of land that have never yet been thought capable of admitting of such a mode of fertilization; and, in others, by having recourse to damming them up, and the occasional use of wooden pipes in the conveying it, when necessary, may be easily raised to heights sufficient for conducting it over many more elevated lands, and thus promote their vegetation and produce in an incalculable degree.

On heathy moors and mountainous tracts this system might often be applied with a prospect of most ample advantage. Innumerable



instances are daily occurring to the attentive observer, in traversing these hills, of little rivulets or rills, insufficient to form a regular course, spreading their waters, and providing a most beautiful verdure; thereby affording the fullest proof of what improvement might be effected by the judicious application of this fluid. It is not, indeed, improbable but that, by the aid of machinery, water may be forced up so as to be dispersed at such levels as cannot at present be easily conceived.

The same principles may be applied, in many situations, in conveying the rich liquors collected in ponds and reservoirs about the farm-yards and buildings, that are too frequently wasted by evaporation or other means, over the adjoining fields, as has been practised by Mr. Fenna, in Cheshire, and described in the second volume of Communications to the Board of Agriculture.

A variety of useful hints and observations on the means of effecting the business of watering on grass lands in different situations and circumstances, with references to figures for managing the works in the different cases, have been given by Mr. Marshall in his work on the Landed Property of England. The advantages that may be derived from the same practice on arable lands are likewise noticed.

The chief objection to this method of improving meadow lands is the first expense of the business; but if it be conducted in a judicious manner, this will seldom form any real impediment, as the almost immediate increase of produce will amply repay the improver. And the object of the cutting of the land is of little or no consequence, if it be thereby made to afford additional supplies of food for the support of stock, and at the same time contribute to the gradual improvement of the soil.

*Warping.*—There is a mode of improving land by *warping*, or the admitting of the tide waters of large rivers near the sea upon the lands for the purpose of depositing their rich materials, which are denominated warp, and in that way forming as it were a new soil. It is much practised in some parts of Lincolnshire as well as Yorkshire, and has been fully described by Mr. Young in his valuable Report of the first of these districts. But as it can only be employed with advantage in a very slight degree upon grass lands as a manure, and as its application has been already considered in the management of tillage ground, it does not appear necessary to describe the practice more fully in this place.

*Mowing of Hay Lands.*—In the cutting of grass crops for the purpose of being converted into hay, it is necessary that they be in the most suitable states of growth and maturity for affording the best and most nutritious fodder. With this view, it would seem that they should neither be cut at too early a period, or suffered to stand too long; as in the former cases there will be considerable loss in the drying from the produce being in so soft and green a condition, and in the latter from a large proportion of the nourishing properties being expended. It is probable, therefore, that grass, when mown before it becomes in full flower, while the rich saccharine juice is in part retained at the joints of the flower-stems, is in



the most proper condition for being cut down, as at that period it must contain the largest proportion of nutritious material, but which then begins to be absorbed and taken up in proportion as the flowers expand and the seeds ripen, so as to constitute the meal or starch of the seed-lobes, and is either dispersed upon the land or fed upon by birds, the grass-stems with their leaves being left in a similar situation to that of the straw of ripened grain.

But there are other circumstances besides those of ripeness to be attended to in determining the period of cutting crops of grass; as in some cases, where they are thick upon the ground, the bottom parts become of a yellow colour before the flowering fully takes place: under such circumstances, it will always be the most advisable practice to mow as soon as the weather will possibly admit; for if this be neglected there will be great danger of its rotting, or at any rate of its acquiring a disagreeable flavour, and of becoming of but little value. Where grass is very tall, as is often the case in moist meadows, it is liable to fall down and lodge, by which the same effects are produced. In this case also the mowing should be performed as soon as possible.

But where there is nothing of this sort, it appears evident that the most proper time for performing the business is when the grass has begun to flower, before the seed-stems become hard and wiry; as at this period it would seem to contain the largest proportion of useful matter. Besides, when let stand too long, the after-grass is not only less abundant, but there is great loss by the crumbling down of the stems in the different operations of hay-making. The usual time of cutting for hay in the first crop is from about the middle of June to the beginning of the following month, according to the nature of the land, and as the district is more early or late.

In the operation of mowing, the chief art consists in cutting the crop as close to the surface of the ground as possible and perfectly level, pointing the swaths well out, so as to leave scarcely any ridges under them.

In cutting *rouen*, or second crops of grass, more attention in these different respects will be requisite than in the first, as the crops are mostly much lighter and more difficult to cut, the scythe being apt to rise and slip through the grass without cutting fairly, except when in the hands of an expert workman. Crops of this sort should always be cut as much as possible when the dew is upon them, and as soon as ever there is a tolerable growth, as by waiting, the season is constantly getting more unfavourable for making them into hay; and when not well made this sort of hay is of little or no value.

The quantity of ground that can be mown in any given space of time must depend, in a great measure, upon the weight of the crop and the capability of the workman, but in general an acre is considered as a full day's work for a good mower.

When the grass has been decided to be in the proper condition for being cut down, a set of mowers, proportioned to the extent of the crop, should be immediately provided. In some districts it is the



custom to pay these labourers by the day, but a better and more general practice it to let the work at a certain price by the acre. A suitable number of hay-makers are likewise to be obtained; in some cases two or three are deemed sufficient for each mower, but in this district the usual number, including pitchers and stacker, is about five, who proceed with their work after the mowers, and are paid by the day. In hot or windy seasons a larger proportion will be necessary than when the weather is cloudy and cool. About one half may be women. If a due proportion it not preserved, much inconvenience and disadvantage will arise in having too much cut grass on hand to be perfectly managed.

*Hay-making.*—The great art of converting grass into hay consists in rendering it sufficiently dry to prevent its taking on too great a degree of heat in the stack or mow, and at the same time preserving a large proportion of the natural juice of the plants. Where the medium can be attained with the most exactness, the best and most nutritious hay will be produced. It is, however, a difficult point, that requires much care and attention. In fine seasons, the great danger is of not making it sufficiently, while in those of the contrary description it is apt to be made too much. This is fully evinced by the great inconveniences that are frequently sustained from the heating of the stacks in the former cases, while in the latter it is but seldom heard of.

It has been suggested by an accurate observer, that in the making of hay “some attention should be paid to the quality of the soil and the kind of herbage growing upon it. The hard benty hay of a poor soil is in little or no danger of heating too much in the stack: it should, therefore, be put very early together, in order to promote a considerable sweating, as the only means of imparting a flavour to it, which will make it agreeable to horses and lean cattle, as it will be nearly unfit for every other sort of stock. It is the succulent herbage of rich land, or land highly manured, that is most likely to generate too great a degree of heat; of course grass from such land should have more time allowed in making it into hay. In moderately hot seasons the proper point of drying may be easily judged of; but when they are very hot and scorching it is easy to be mistaken; as in such weather the grass becomes crisp, rustles, and handles like hay, before the moisture or sap is sufficiently dissipated for it to be in a state fit to be laid up in large stacks. If that, however, be done when it is thus insufficiently made, it mostly heats too much, becoming mow-burnt in some cases.

There is another circumstance, which, though difficult in many cases to be performed, is of much consequence; this is that of “carrying the whole of the hay just at the moment it is sufficiently made; which is necessary in order to its yielding the greatest possible weight, and preserving its best quality; as every minute after that precise time it continues to lose, both in weight and in its nutritious properties, by evaporation,” as is evinced by the smell. “Even the difference of an hour, in a very hot drying day, is supposed to occasion a loss of 15 or 20 per cent. on the hay, by its



being carried beyond the point of perfection, and frequently even a greater loss is sustained."

The art of hay-making has been observed to have been brought to a degree of perfection in this district altogether unequalled by any other part of the kingdom. The neat husbandry and superior skill and management, so much and justly admired in the arable farmers of the best cultivated districts, may, with equal justice and propriety, be said to belong, in a very eminent degree, to the hay-farmers of this part of the island, as they may very fairly claim the merit of having reduced the art of making good hay to a regular system; which, after having stood the test of long practice and experience, is found to be attended with the most perfect success. Even in the most unfavourable seasons, the hay made according to this method, is superior to that made by any other under similar circumstances. It is, therefore, to be regretted that this very excellent practice has not yet, except in a very few instances, travelled beyond the limits of the county. But as it highly deserves the attention and imitation of farmers in other districts, we shall describe the whole process, from the moment at which the mower applies his scythe, to that in which the hay is secured in the barn or stack.

The chief part of this sort of labour is performed by means of small forks made for the purpose.

In the first day's process, all the grass mown before nine o'clock in the morning is tedded or spread out, great care being taken to shake it so as to leave it free from lumps, and to strew it evenly over the whole surface of the ground. It is soon afterwards turned, with an equal degree of care and attention; and if the number of hands be sufficient they turn the whole again, or at least as much of it as they can before twelve or one o'clock. It is then raked into what are termed single windrows, or so as that each person may form a row at about three feet distance; and the last operation of the day is to put it up into grass-cocks. The business of the succeeding day commences with the process of tedding all the grass that was mown the first day after nine o'clock, and all that was mown this day before the same hour. The grass-cocks are then well shaken out into what are called staddles, which are separate plats of five or six yards in breadth. Where the crop is so thin and light as to leave the spaces between the staddles rather large, they are immediately raked clean, and the rakings mixed with the other hay, in order to its all drying so as to be of an uniform colour. The staddles are next turned, and after that the grass that was tedded in the first part of the morning once or twice, in the same manner as described in the first day. This business should all be performed before twelve or one o'clock, that the whole may lie to dry while the people are at dinner. After this the first thing is to rake the staddles into double windrows, which is done by every two persons raking the hay in opposite directions or towards each other, forming a row between them of double the size of the single windrows, each being about six or eight feet distant from the other. They afterwards rake



the grass into single windrows, then put the double windrows into bastard cocks; and conclude by putting the single windrows into grass-cocks. The labour of the third day is begun by first tedding and spreading out the grass mown and not spread the preceding day, as well as that mown in the early part of this day, and then the grass-cocks are thrown out into staddles as before, and the bastard cocks into staddles of less extent. These narrow staddles, though last spread out are first turned, then those which were in grass-cocks, and lastly the grass is turned once or twice before twelve or one o'clock. When the weather has been sunny and fine, the hay which was last night in bastard cocks will this afternoon be in a proper state to be carried, as in fine seasons it may mostly be performed on the third day; but when the weather has been cool and cloudy, no part of it probably will be fit to carry. In that case, the first business after dinner is to rake that which was in grass-cocks last night into double windrows; then the grass which was this morning spread from the swaths into single windrows. After this the hay which was last night in bastard cocks is made up into full sized cocks, and care taken to rake the hay up clean, and also to put the rakings upon the top of each cock. And lastly, the double windrows are put up into bastard cocks, and the single ones into grass-cocks, as in the preceding days. On the fourth day the great cocks just described are mostly carried before dinner. The other operations are similar to those of the former days, and proceed in the same order, continuing them daily until the whole is finished.

During the whole course of hay-making the grass should, as much as possible, be protected, both in the day and night, against rain and dew, by cocking.

In districts where the hay season is later and the weather more changeable, it would often be dangerous to expose the hay so much abroad as in the above process; a more cautious method should probably be adopted. In such cases, instead of keeping the hay almost constantly spread out and exposed to the atmosphere, as in the preceding method, it may be better to put it into small cocks soon after it has been cut down and become a little made; these should then be frequently turned over, but not spread out, except when the weather is in such a fine state as to insure their being put up again in the same state, without injury from the falling of rain. This method is much more slow, though the hay is less exposed to danger in wet weather than in that which has been described above; and when there is much heat it may be made with little trouble or expense, and without much expenditure of its nutritious juices.

Another practice that has been found useful in such situations is, to break out the grass that is mown, turn and windrow it the first fine day, and also to put it into small cocks when the ground is dry; on the next fine day a few of the cocks are broken out at a time, and kept constantly turned till fully dry. Three or four of them are then put into one cock, the work proceeding in the same manner till the whole is done. And when the weather is bad these cocks are never re-broken out, being only lightened up to let the air pass through them more freely.



The advantages in the first mode are supposed by some to be, that from the regular tedding that is given the hay becomes of a more valuable quality, heats in the stack or mow in a more uniform and equal manner, and cuts out better in the truss.

It is likewise well observed, that no more of the produce should be thrown abroad than can be put up into cock the same day, or before it is injured by the fall of rain. When the weather is unsettled, it may often be permitted to remain in the swath for several days, only taking care that the undersides do not become discoloured by turning them over by the head of the rake. In this way it will frequently be so much made, in a few days, as to require little tedding afterwards to form good hay.

The preserving hay of a proper green colour is a circumstance of some importance. In order to effect it, the bastard cocks, previous to their being carried, should be put up in the heat of the day, and remain in that condition till the following morning, when they must be turned and opened so as to dispel any damp that might induce it to heat in the stack, and in that way spoil the colour. The acquisition of a lightish brown colour in the stack is not found injurious to hay, but where it becomes of a *dark* brown from too much heat, it is said to weaken and relax horses that are fed upon it by its powerful diuretic quality. It is of course of inferior value.

The *rouen*, or second crops of hay, from their being slender, having fewer succulent stems, in most cases require less time in being made into hay than the first. In securing this sort of hay it is, however, advantageous to have it well made, as without this it will be very liable to grow mouldy in the stack, and become of a bad colour from taking on too great a degree of heat, as the less it heats in the stack the more green the colour will be.

*Stacking and Thatching Hay.*—In performing this business it is always advisable to have staddles made for the purpose, somewhat in the same manner as those that have been recommended for grain, though it is too common a practice to build hay-stacks without ever attending to this circumstance. They need not, however, for this use be raised so high, or have any shelving outwards, but be quite plumb and without copings. In the common method of placing them upon the ground, on a little drift, or a few pieces of wood laid across each other, there must constantly be great loss in the bottom parts of the stacks from the moisture being absorbed by the hay; but by the use of staddles this may be wholly avoided, and the expense will be but a trifle, as any old rough pieces of wood will answer the purpose.

In respect to the form of the stack it is not a matter of much consequence, the long square or oblong shapes are the most safe and convenient, especially when not too broad, as they admit the air most fully. Besides, they are the most convenient to cut from in trussing hay for sale. But the circular form for farm use, where straw is scarce, may be the most advantageous in the economy of straw in thatching. The size of the staddle or stack bottom should be proportioned to the quantity of hay, but it is better not to have the



stacks too large; twenty-four feet by fourteen or fifteen is for most occasions a good size.

The business of stacking hay is best performed, if possible, while there is a full sun, especially when the season is indifferent, as by that means it is much improved. It is necessary to have a person that understands the art of setting up stacks, and a sufficient number of helpers to assist in spreading the hay and treading it well down. In building, the middle of the stack should always be well kept up, something higher than the sides. In this district, where work of this sort is well executed, at leisure times, during the whole period the stack is building, the men are employed in pulling the sides and ends into proper form. And it is common to have a large sail cloth raised on poles, which covers the whole and prevents its being injured by rains until it is finished.

In order to prevent the hay-stacks from heating too much, holes, pipes, chimneys, and other contrivances are sometimes formed in the middle of large stacks, to draw and conduct off any superabundant heat. It is better, however, to avoid these as much as possible; as the hay round them is always much injured by attracting the moisture of the stack. Mr. Young mentions an useful practice of Mr. Duckett's, not only for ascertaining the heat and preventing its proceeding too far, but for showing the colour of the hay. It is by thrusting in a stout iron bolt into the stacks, to form a passage for a gun rod with a strong worm at the end, by which a sample is screwed out and the state of the stack discovered. Where air is necessary holes are made in different places, to let the heat pass off and prevent the hay from being injured.

In building the upper parts of stacks of hay, corn, or other materials of a similar nature, some contrivance of the *stacking stage* kind is necessary, in order to enable workmen to pitch the substances with convenience to the person who stacks them. The common method of performing this is by means of a framed stage, set upright, sufficiently near the stack to suit the workman who pitches the hay or grain to it. But a stage of this sort, which appears to be better contrived, and which is more simple and cheap, is described by Mr. Young, in his excellent Report of the Agriculture of the County of Suffolk. It is suggested that this stage may also be employed for nailing up weather-boarding, painting the outsides of buildings, plastering of walls, and several other purposes of the same kind. This stage may be seen in plate

After the work of stacking has been completed, and the stack is pulled and topped up, it is left till it has sweated, and is perfectly settled, which is mostly the case in a week or ten days; the roof should then be covered by a good coat of thatch, or secured by means of a straw rope, extended along the eaves across the ends, and on either side just below the ridge. This rope is usually secured by means of pegs. The roof should be dry when the thatch is put on, to prevent the hay from becoming mouldy. It is of great consequence that this sort of work be well performed, the farmer



should of course always have attention to it, as labourers are often apt to slight it.

It is a point not perfectly decided among agriculturists, whether hay keeps better in stacks in the open air, or in barns for the purpose. It is the opinion of most farmers in the southern districts of the kingdom, that the first mode has the advantage in so far as respects the quality of the hay.

In many of the more northern parts of the island the hay is, however, secured in the barn, and has appeared, in all the examinations we have made, equally good and sweet with such as has been preserved in the open air. And the trials of Mr. Middleton, as stated in the Middlesex Report, seem to support the same supposition, as in securing hay in his barn, without clearing it from the quartering on the sides, he found on cutting and binding it up, that it was equally good in quality with that from the stack-yard, and as perfectly free from dust. The hay was made without rain, and that which was the least made put in the barn. Barns are observed to have other advantages, being "extremely useful and convenient during a catching and unsettled hay-harvest, and also at other seasons of the year. In wet and windy weather they afford an opportunity of cutting, weighing and binding hay, none of which operations could at such a time be performed out of doors." All the farmers who were consulted on the subject "agreed, that hay might be put together earlier, even by a day, in a barn, than it would be safe to do it in a stack."

In answer to objections made on the grounds of the practice not repaying the expense of large barns, it is remarked by the same writer, that it is "in direct opposition to the opinion of the best hay farmers in the country, and contrary to his own experience, for in the driest seasons barns are a saving of four or five shillings an acre; and in wet seasons, the ready assistance which they afford in speedily securing the hay, has been known to make a difference in price of twenty shillings per load on a small number of loads." There are other advantages in the use of barns for this purpose, as there is not only less litter and waste, but in merely hay districts, a great saving in straw, which is now an expensive article in many places, especially near large towns.

But without having recourse to the erection of expensive barns, many of the conveniences and advantages of them, especially those of saving the labour and expenses of thatching, may be obtained by the use of covered sheds, raised on pillars or posts, and open on all the sides. These may be constructed in a cheap manner by having the roofs made with thin feather-edge boards, well payed over on the outside with tar or paint. These are light, cheap, and will last a great length of time by care in keeping them well painted.

On some hay farms the dependence is chiefly upon the sale of the article, which is conveyed to the market after being cut by a knife, and bound up into trusses weighing fifty-six pounds each, thirty-six of which form a load, or about eighteen hundred weight: but



when sold fresh from the field, twenty hundred weight constitutes the load. When the hay has been preserved in a perfectly good condition, there should not be the smallest waste in the binding: the loose parts being put in the middle of the trusses, and the bands twisted from the long coarse parts.

The quantity of produce obtained from an acre of grass land must be different, according to the fertility, management, season, and other circumstances; but from one or two loads is the usual proportion.

For the purpose of facilitating the business of getting the hay together in bad showery seasons, *hay-sweeps*, *rakes*, and *sledges* have been constructed.

A contrivance of the first sort has been invented by Mr. Middleton, which seems to be possessed of merit. It is so constructed as to be drawn by four horses in pairs, but smaller ones might be made to be drawn by two, and is managed by two boys, one of whom drives each pair of horses, being mounted on one of them. Where the ground is level, little more will be necessary, in order to assist the machine, than merely to break and turn up the rows of hay in different places; but where the ridges are high, and there are considerable inequalities of surface, it will be requisite to assist the implement by occasionally sticking the prongs of a fork into the still hay just before the machine, that it may more effectually catch it.

In Yorkshire another sort of contrivance, termed a *hay-sledge*, is employed for the same purpose, and in some situations is probably to be preferred; as where the land is dry, the ridges high, and the ground irregular in the surface. With this machine and two horses the hay may be collected together, loaded and carried to the stacking place, in much less time than by means of a cart. In loading it, the hay is first to be raked into rows, when the sledge is brought to the end of one of them, and one of the horses made to pass on each side, until it has collected a sufficient quantity for a load, one of them then crossing the row of hay, the load is conveyed to the stack; when by the horses being turned about, the sledge is drawn back, leaving its load behind it.

The most economical and advantageous methods of consuming this sort of fodder will be considered when we come to speak of the different modes of managing live stock.

*After-Grass, or Rouen.*—In some districts much of the after-grass is frequently cut and made into a green soft sort of hay, in the manner that has been already mentioned; but in others it is fed off by live stock in the autumn. Both modes may be useful under different circumstances. In situations where plenty of manure can be procured, as near large towns; and where the chief dependence is upon the sale of hay, or where lamb suckling prevails, it may frequently be a beneficial practice to take a second crop of hay, as the first may by that means be more fully spared for sale, the after-crop supplying the cows or other cattle that may be kept on the farm. But in cases where manure cannot be easily obtained, and there is no local practice carried on, that particularly requires such sort of hay, it is better to let it be fed off by stock than run the risk of ex-



hausting and injuring the ground by the taking off repeated crops. There is also another circumstance to be considered in this business, which is that of the state of the land in respect to dryness; as where it is low, wet, and very retentive of moisture, it may be often more hurt by the poaching of the cattle in feeding off the herbage than by taking a second crop of hay. Independently of these considerations, it may, however, in general, be a more safe and useful practice to eat off the after-grass by stock, and only take one crop of hay, as by such means a more abundant annual produce may be afforded, and the land sustain less injury.

Where a crop of rouse is made into hay, the most profitable application of it is probably in the foddering of such cows as are in milk, as it is well suited, by its grassy quality, and its not heating so much when well made as other sorts of hay in the stack, to afford a large flow of milk. It is this reason that induces the cow-farmers to cut their grass so many times in the summer. Another beneficial application of this hay is in the feeding of such ewes as are employed in the suckling of house-lambs during the winter season; the intention in this case is the same as in that of the preceding instance. There is another advantageous use to which this sort of produce may be applied, which is that of supporting young calves and all sorts of young cattle that are kept as store stock.

Where sheep require the support of hay in the winter season, it is also well adapted to that use.

Where after-grass is fed off by stock, there is much difference of opinion in regard to the most proper periods of turning in the animals. Some have contended that it is the best practice to let them into the field before the young grass has attained any very great head; while others maintain the opposite doctrine, and think it the best method to allow the grass to get up to a full bite before the stock is turned upon the land. Both endeavour to support their opinions by experience. But as they cannot be both of them true, it is probable that the extremes of each are to be avoided; and that, as in many other matters, the truth may lie in the middle. This is indeed equally supported by fact, and the observation of the most intelligent managers; as when the cattle are turned in too early there is not a sufficient bite to keep up the condition of the animals; while in the contrary extreme, the stock so soon fill themselves, that much of it is trodden down and wasted afterwards in their roaming about the fields to pick the sweetest morsels. In confirmation of this opinion, Mr. Marshall found in the midland districts, that milch cows fell off in milk, and bullocks in flesh, on being put in too early, before there was a sufficient bite. This he, however, seems to consider as arising from the want of nutritious quality in the grass in this state. And the incautious observation of common farmers has ascribed it to the inconvenience the animals sustain in feeding from the stubs. It is not, however, probable, that either is the case; for as soon as the scythe has separated the old grass from the roots, new shoots are made that are highly sweet and nourishing. This may be easily perceived to be the case on examining a piece of ground soon after its being mown, and tasting the young



shoots. The supposition respecting the stubs is shown to be founded in error, from the circumstance of the stock devouring the herbage with avidity, as Mr. Marshall has well remarked. Besides, the animals lick in their food by the tongue, which is armed for the purpose before it is bitten, and do not push their noses so as to be inconvenienced by the stiffness of the cut grass-stems. It is possible, however, that some effect in lowering the condition of the stock may arise from the laxative effect that may at first be produced on the animals by such young succulent grass.

Where much stock is turned upon after-grass in a full state of growth, there cannot be any doubt but that much loss must, as has been just observed, be sustained by the treading down and rendering the grass unfit for being eaten off. This is sufficiently evident on viewing fields fed in this state.

It is therefore perhaps only by beginning the pasturage of after-grass when in the middle state of growth that it can be consumed to the best advantage, and without loss in either of the ways that have been just noticed. This practice seems to be countenanced by the observation of an agriculturist who has had much opportunity of information on the subject.

The manner of feeding down after-grass varies much in different districts: it has been observed by a farmer in Middlesex, that the condition on which he rents his farm, is that of taking out the heavy cattle at Michaelmas, but that sheep remain till February: in this country the practice is to turn on the cattle immediately after mowing. But in the northern districts the grass, to which they have given the name of eddish, is kept till November or even a later period for the purpose of finishing fat stock, or for the pasturage of milch cows, from which a superior quality of cheese is made, and by which time it has attained a considerable head: however, this latter practice would seem to be attended with some loss, from its being trodden and trampled under foot, as may be readily perceived by examining the field.

In the stocking of after-grass, some attention is necessary not to have too great a number of animals on a given proportion of land. To overstock produces injury in various ways, especially on first turning in, but particularly by too much treading and beating down the grass. Mr. Marshall found the midland graziers of opinion, that one cow to the acre on well grown after-grass was an ample stock. Good grass-land may, however, admit something more.

In the pasturage of rough, or after-grass, by heavy cattle in the autumn, great injury has been complained of from their poaching the ground, particularly at a late period in that or the winter season. On this account it has been recommended to confine the consumption of this grass principally to the support of sheep, unless in very favourable seasons, or where the soil is uncommonly dry, in which cases milch cows or other heavy cattle may be admitted without inconvenience.

It is the practice in cases where there is a great scarcity of spring feed to reserve after-grass in the autumn for spring use. Some on the basis of experience contend that it is the most certain, and



on the whole, the best spring feed yet known, This would seem however to be a wasteful practice, at least in respect to the more forward after-grasses. The forwardest ought certainly to be eaten without waste, before winter sets in; and the latest, that is to say the shortest, may be shut up for spring feed. If after-grass be too long and gross, it is apt to lodge and rot upon the ground in winter; therefore on rich lands, it should always be more or less fed off before Michaelmas, in order to prevent its being wasted or lost in the winter. An experienced agriculturist found, from repeated experiments, that old after-grass feeds sheep that give milk better than turnips, which are more adapted to the fattening of stock; and that this grass holds to a period, if wanted, when most other resources fail, the last half of April, and the first half of May—periods always of want and difficulty, where rye grass is not sown. Mr. Marshall also assures us, that as a certain and wholesome supply of food for ewes and lambs in the early spring, the preserved pasture is to be depended upon as “the sheet-anchor,” in preference to turnips, cabbages, or any other species whatever of what is termed spring feed.

The same thing has been experienced by Dr. Wilkinson, who has observed that this food with him afforded a more nutritive and healthful quality of milk from the ewes to their tender lambs than turnips, even in their best state.

But however useful after-grass pastures may be under this management, there is evidently a great loss of food incurred by it, especially in severe winters: it would therefore seem to be frequently the best practice to eat after grass well down, as late as possible in the autumn, by different sorts of live stock, and depend in a great measure upon the new grass for spring feed.

It has been suggested that mowing the preserved after-grass in the winter, and giving it to the stock in the farm-yard, might be advantageous in preventing the land from being poached, and the useful long grass from being trampled down and destroyed. The trouble and expense of the process would perhaps in general be too great, though in particular circumstances, as where other sorts of fodder do not bear a proportion to the quantity of stock to be kept, and where sheep are conceived improper, it may afford some convenience and benefit, especially where it can be performed without injury to the ground by poaching, in the conveying away the materials, which can seldom be the case except where the land is very dry; in which situations there is rarely much after-grass for this purpose.

Where the nature of the soils is such as not to admit heavy cattle early and late, lamb suckling may often be carried on with advantage, as well as the feeding and fattening of other sorts of sheep, which is frequently the case in this district.



## SECTION XX.

*Cultivation of Grass Land.—Pastures.*

**HAVING**, in the preceding section, explained the different methods of management that seem necessary in the cultivation of those sorts of grass lands that are chiefly applied to the purpose of producing hay, we shall now describe the modes of practice which appear requisite in such as are almost wholly appropriated to the support of live stock.

*Pasture Lands.*—The grounds that are the most perfectly adapted to this use are, all those which have a considerable depth of good mould, and at the same time that they afford a good herbage, are so dry in their nature as to admit the animals to feed upon them at almost all seasons without injury by poaching. Coarse rushy lands may, however, in many cases, be converted into good pastures, by proper attention in draining, and cutting over the rushes in the early part of the spring, as by this means the water enters their stems and the plants decay, the young shoots being afterwards eaten by young stock, and the good grass plants allowed to flourish. There is also another sort of land that may be employed in this way, which is that of the moory kind, consisting of much imperfectly reduced vegetable matter proceeding from the leaves and roots of various decayed vegetable productions, that require to be brought into a suitable condition for the support of grass plants by proper drainage and the application of substances of the fossil kind.

Pasture lands should likewise, as much as possible, possess properties in the nature of their grasses that are the most advantageous for the particular method of management under which they are to be conducted. In this view, some may be adapted to the producing of milk or butter, others of cheese, and others again of feeding or fattening animals. It is in some measure on this account, as well as that of local convenience, that different modes of management are employed on grass lands.

The difference of situation in pasture lands has likewise much influence in directing the uses to which they may be applied with the greatest benefit; the higher or more elevated grounds being in general more proper for sheep, while those of the lower and more inclosed kinds are mostly better suited for the purpose of neat cattle or other animals under the fattening system. And besides, the age of the lay makes a difference in some cases: new laid down pasture lands being commonly found more proper for the support of the young store animals, while those that have been long in the state of sward are in general better adapted to the feeding or fattening stock.

The mode of enclosing has also some effect in the same way; as when the inclosures are of a moderate size they are found more suitable for the purposes of feeding than where the contrary is the case.



This sort of grass land, as well as that of the hay kind, is subject to be overrun and much injured in its produce both by moss, coarse plants, and ant as well as mole-hills. This is often the case here to a much greater extent than in the hay lands. These should therefore be constantly removed, or spread about as soon as possible, and prevented from obstructing the complete pasturage of the lands in the manner that has been recommended above.

On the marsh grazing lands in Kent, where ant-hills frequently occur, they have a mode of extirpating them in an easy and expeditious way, and of bringing the surface level, which is by the use of an implement, eight or nine feet in breadth, which is armed with a sort of strong cutting blade. When in use, it is drawn by a horse directed by a boy, and guided behind by a man, and is often capable of cutting off several of the hills at one stroke, and of course clearing a number of acres in a very short space of time. There are various other ploughs in use for this sort of work.

But, besides these, pastures, when not well attended to, are frequently prevented from being properly fed, by various kinds of low shrubby plants, such as those of the alder, brier, broom, furze, and other sorts that shoot out upon the surface, and which should always be extirpated, as soon as the business can be conveniently done; as by their remaining upon and shading the ground they render the herbage sour, and improper for the food of cattle. This sort of work may be performed by cutting them closely down as they rise in the early spring months; but a better practice is to dig them or plough them completely out in the manner that has been described in speaking of the methods of bringing lands into the state of cultivation\*. The shrubby, black, and other thorns and briars that spring up from suckers on the sides of the edge-rows of pasture grounds, should likewise be extirminated, especially where sheep are pastured, as they do great mischief by pulling and entangling their coats. Besides, much ground is often lost in this way, and the appearances of the edges is disgusting. In many cases after the plants are stocked up, the earth about them might be thrown up into a compost with a small proportion of well-rotted dung, and spread upon the land with much benefit; and at the same time the land thus cleared be brought into a proper condition for being sown down with grass seeds.

Where pastures are productive in grasses of the more sharp coarse bladed kinds which rise into tufts or tussocks, and which are known to agriculturists under different titles as sour coarse grasses, and there are other sorts of aquatic plants presenting themselves, it is a certain indication that the soil is too retentive of moisture, and not only stands in need of draining, but also of being kept in a close state of feeding by different sorts of stock.

The manuring of pasture lands is a business much less in practice than ought, perhaps, to be the case, as where the soil is not good, and they are kept in a constant state of feeding or pasturage, it would seem probable that their fertility must in some measure

\* Section on the Cultivation of Arable Land.



decline, if proper means be not taken to preserve and keep it up, even though they should be fed down with sheep, which is unquestionably in this view the most favourable sort of stock. It is indeed hardly to be supposed that the small proportion of excrementitious matter that is dropped at random during the feeding of the animals, especially the larger kinds, under an exposure to the dissipating and washing effects of the atmosphere, at different seasons, where no other sorts of food than that of the natural grasses of the pastures is consumed, can in such sorts of land be adequate to the restoration of the great degree of fertility that is constantly conveyed away in the time of pasturing. In the better kinds of pasture lands, where the produce of grass is considerable, improvement may, and undoubtedly does, take place by feeding them, especially by sheep, as the discharges of the animals are not only more abundant, but a proportion of old grass is left to decay during the winter season, and in that way make an annual addition to their fertility. It appears probable to us, however it may differ from opinions that have been held on this subject by some cultivators, from much close attention to the management of grass lands of the less rich kinds in the state of pasture, that in such case, unless attention be paid to improve their condition by some other means than merely that of the manure dispersed over the land by the animals in simply consuming the herbage, that they must in time become gradually deteriorated, and the quantity of pasturage be lessened so as to support smaller proportions of stock than was formerly the case. This supposition seems indeed, in some degree, supported by the condition of downs, and other uninclosed lands that have been in a state of pasturage for a great length of time; as in these cases, if feeding had rendered them more fertile, they must long since have been enabled to carry a vastly increased proportion of stock; which is certainly not the case.

That feeding down pasture lands, of these as well as other kinds, in a judicious manner has the effect of rendering the herbage more fine and better for the support of stock in general, there cannot be the smallest doubt; but it does not certainly follow that the fertility of the land, in such cases as have been just mentioned, is thereby really improved, as has been supposed by some employed in the business of grazing in particular situations and circumstances. Where the pastures, as has been just observed, are in such heart as to afford a large quantity of herbage for being converted into manure, and sufficient to permit a portion annually to revert to the state of vegetable mould by its undergoing the process of putrefaction, a considerable progressive improvement must, without doubt, be the case under the pasturing system, especially where sheep constitute the principal stock. And in most cases the fining of the herbage by this practice must be advantageous. It seems, therefore, not improbable but that the bettering of the condition of the herbage by feeding the lands with sheep may have occasionally led to the supposition that the fertility of the grounds was thereby in *all* cases, really improved. That an increase of fertility is produced, in most instances, by the pasturing of lands with sheep, is not disputed; it



is only in particular circumstances that the contrary is contended to take place. And in all cases the injury that may be sustained in this way must evidently be very small, when compared with that which takes place from repeated mowing without the application of suitable dressings to the lands.

The immediate improvement of the fertility of pasture grounds may be effected in different ways, as either by the direct application of manure in its natural state, such as that of rotten dung, lime, marl, or in that of earthy compost, occasionally over their surfaces in a thin even manner; or indirectly by the folding or confining of sheep upon the land during the time they consume other sorts of green food, such as turnips, &c. The latter mode is unquestionably the most advantageous and convenient, as it is in but very few situations that the former can be practised without injury to the arable or hay lands. By proper attention in this way the more poor pasture grounds might soon, and at little expense, be brought into a good state of pasturage; which could seldom or ever be the case without it.

The most proper period for turning the stock into the pastures in the spring season has been a matter of dispute among those employed in the management of grass lands; some contending that it should be done early, before the natural grass has risen to too great a bite, while others maintain the contrary opinion. There are probably inconveniences attending each of these extremes, as in the first the stock, especially when of the attending kind, may sustain injury from the want of a sufficient bite to permit the animals to fill themselves in an expeditious manner; and in the latter there may not only be much waste by the stock not being capable of keeping it under, but great loss and inconvenience from its running up in tufts to seed, and by that means rendering the pastures patchy and unevenly fed down, by which the extent of real pasturage is lessened. It has been also observed, that by turning the stock upon the pastures when there is a full bite the better sorts of grasses are only consumed, the more coarse herbage being rejected and let run up to seed, by which the lands are greatly injured at the time as well as in future; while, on the contrary, if the stock be allowed to enter during the time such coarse plants are in their more tender early growth, and before the pasture is covered with better herbage, the whole of the other plants will be fed down in a regular manner with the grass. It is likewise remarked by the same writer, that the want of a full bite on the first turning out of store stock is of advantage to the animals, as they become more gradually accustomed to the change from dry food to succulent herbage. And it is supposed that fattening stock only require a full bite on being first put upon the pasture. In answer to the objection that has been made, that early turning upon pastures exposes them more to the effects of drought in the spring months, it is said that it is in a great measure ill founded, since cattle milk and thrive well in such cases. “It is not,” Mr. Marshall remarks, “the length of grass, but the quantity of nourishment which it contains, that makes cattle pay for their pasturage.” And it is not supposed improbable but that the



richness of the herbage may in some degree depend on the sun or heat of the season.

As the state of grass which is the most favourable to the feeding of the stock, and their expeditious filling themselves and taking their rest, as well as that of their wasting the least possible proportion of the food, would seem to be that of a middle degree of growth, it is not improbable but that, that may be the most proper and advantageous period for breaking the pastures; the exact time of which must obviously be regulated by the nature of the soil, the situation of the land, and the state of the season. From the end of March to the latter end of April, or beginning of the following month, according to the forwardness of the season, may be the most advantageous in the southern districts, but in those of the north it may be deferred a week longer or more with benefit.

In regard to the general eating down of pasture lands there is likewise much difference of opinion, some advising that it should be done in as close a manner as possible, others that this should never be the case. It would seem, however, that the closeness or degree of feeding that is the most proper should be directed by the nature of the grass and the time at which it is performed, as where the herbage is of the coarser kind and consumed in the autumnal season, it may be done much more closely than in the contrary circumstances, as such sorts of grass must always be improved by such close feeding, and no injury can be sustained at such seasons from the roots of the grasses being left so much exposed, which would be the case in the later spring or early summer months, from the constantly increasing heat at such periods.

The advice that has been given by an intelligent observer on this subject may in general be adopted with propriety, which is, to be cautious not to overstock, as by that means great loss may be sustained, as "land when fed too bare is apt to burn in summer and to be chilled in winter. Besides, the necks of the roots of the grass plants are so injured by very close biting that they do not afford so quick or free a spring to the succession of blade as there would otherwise be." But, on the other hand, it is not recommended to leave a long bite of grass on the land: a middle degree will suit all lands the best, and afford the most benefit to the persons who occupy them.

By the too thin stocking of pastures, though loss may be sustained in their not supporting the proper number of animals, as well as from the injury which is done by the grass plants running so much up to stems, the broken grass in such cases can be mown when in sufficient proportion for hay: but the disadvantages of overstocking are scarcely capable of being repaired, as, besides the lands being often exposed to much injury by the crowns of the plants being so closely pared down, especially in the finer kinds of grass, the cattle from suffering a check in their feeding, are long in regaining their former thriving disposition. It has been well remarked, that almost the whole of the produce of pasture lands may in this way be often thrown away, and that it is an error that young farmers are extremely liable to fall into.



The medium degree of stocking, which has been advised above, is in general to be carefully adopted from the experience obtained upon the land. In the procuring of which it is best to begin by an under proportion of stock.

It is the opinion of a writer of great experience, that the more various the kinds of cattle are that are fed upon the pastures at different times the better: but it has not been shown on what principle this advantage depends. If the different modes of feeding in the different animals, be attended to and minutely examined, it will be found that though some sorts will consume grass when in a more luxuriant state of growth than others, they are all fondest of pasturing on that which is the most sweet and tender. This is rendered extremely obvious by the observations of an attentive inquirer, who has found, that although horses "appear partial to particular patches of sward, he has never been able to discover any peculiarity in the soil or the herbage of such barely eaten spots." It is supposed that they have been fed down by such animals at first in so close a manner merely by accident; but that afterwards they are kept in such a close state of feeding from their peculiar sweetness, depending on the "peculiar shortness of the herbage." It would, however, seem more probable, from the circumstance of the animals being almost wholly directed by the taste in the choice of their food, that the sweet or tender nature of the herbage in these parts first induces them to feed upon and consume them in so close a manner, as well as the continuing the close eating them down afterwards. The same thing is observed to happen in the vicinity of preserved covers, with hares and rabbits, from their keeping spots of barley or other grain crops closely fed down. And sheep are well known to ramble over the whole of the pastures in order to nibble and pick out the most sweet and delicate morsels.

The feeding of neat cattle is, perhaps, less particular and delicate in this respect; but where not forced by hunger they mostly appear to fix upon such parts of the land as possess the most sweet and palatable herbage, rejecting the coarser spots where it is less tender and agreeable.

If the conclusion be therefore well founded, that stock of all sorts prefer the best, sweetest, and most tender herbage, it is evident that no mixture of animals can insure the even and regular feeding down of pastures, as they will in some degree be all attracted by the sweetest and most tender parts, and those of the more coarse sour kinds be in consequence almost wholly rejected. An agriculturist of great experience and nice observation has remarked, that in pastures stock naturally pick the most palatable grasses first, leaving the others to run up to bents; and though it is admitted that one sort may have a preference for one species of grass and another for another, there is no mixing the animals in such a manner as to prevent this circumstance from taking place. It is wholly impracticable to proportion each kind of stock in such a way to the species of grass that may be most agreeable to it, as to prevent the scarcity of one sort and the abundance of the other.

There are therefore not only difficulties in the regular feeding.



down of pastures from the cattle being more fond of some sorts of herbage than others, but also from the inability of the grazier to proportion them in a way that may fully answer the purpose.

These observations, at the same time that they show the difficulty of the business, convince us of the advantage and importance of keeping pasture lands regularly and evenly fed down, which is perhaps only to be fully effected by one sort of stock properly succeeding another, till the want of the finer sorts of herbage obliges them to feed upon those that are of a more coarse nature. In this, as well as other views, the fattening stock should be first turned into the lands and kept upon them so long as they continue to improve in a proper manner; these may then be succeeded by the older sorts of cattle that require to be brought into condition, and the more young store stock may consume the remainder of the grass, according to the intentions of the farmer. That great utility and advantage may be derived from often shifting the cattle by having recourse to a *head stock* and proper *followers*, there can be little doubt. The few writers that have touched upon the subject of grass husbandry have in general, indeed, recommended the practice as highly beneficial both in respect to the pasture and the stock. And Mr. Marshall, in his *Rural Economy of Yorkshire*, speaks of this being a defect in the grass land management of that district. The correct grass farmer should, therefore, be more attentive to this part of his management than is commonly the case, taking care that the changes of his stock are made in a seasonable and judicious manner.

This is probably a practice from which greater utility may be derived than that of permitting many different sorts of stock upon the ground at the same time, as, besides their not answering the intention of feeding the pastures down with more regularity and evenness, they are inconvenient and disadvantageous in other respects. For where the pastures are fed down with a mixed stock, the animals seldom thrive or fatten so well as where the contrary is the case. They are too much driven about and disturbed by the different kinds teasing each other, especially where horses and neat cattle are put together. A mixed stock is also improper in another point of view; many sorts of animals feed closer and more expeditiously than others; of course, when there happens to be any scarcity of feed, some of the kinds may be greatly injured from the want of proper support. The horse, like the sheep, feeds close and quick, while the contrary is the case with the cow; it would of course seem improper to mix horses with neat cattle in the pasturing of grass lands, though the practice has been prevalent in many places. It has indeed been observed, that sheep and horses may feed and thrive best together, both from the similarity of their manner of eating, and that of the former consuming the rich luxuriant herbage which springs in consequence of the manure dropped in the season, while the latter prefer the less vigorous but the more clean grass. It is a practice, however, that has sometimes been found useful, to mix sheep with neat cattle. The notion of deriving advantage from the mixing of stock, from the circumstances of some sorts having a greater dislike to feed near their own dung and



less towards that of others, is probably not founded on just observation, as all animals have a fixed aversion to both their own and that of other animals, and none of them will feed near either till compelled by the scarcity of food. This aversion does not, perhaps, depend wholly on the dung, but is in some measure avoided in consequence of the grass becoming rank and coarse about such places.

As it is a matter of importance to keep pastures and grazing-grounds as even as possible, a proportion of stock fitted to produce this purpose should always be put upon the lands. On the rich and more fertile kinds, where the grass springs quick and in greater abundance, more stock will be necessary to effect this purpose than where the contrary is the case. It has been found on the marsh land in Lincolnshire, that where the most grass is left in the autumn the herbage is the coarsest and the worst in the succeeding year. In the extensive feeding tract of Romney Marsh, the close feeding system is also found to answer in the most perfect manner. These facts show the necessity of hard stocking on the richer descriptions of land. In other parts of the first of the above districts, on turning upon a full bite in the spring they stock in such a manner as to prevent the grass from becoming coarse by running up to stem. The necessity of sweeping over the rough tufty parts by the scythe is thus avoided, except in very wet seasons.

It is a practical remark of a cautious observer, on describing a field not sufficiently stocked, that, on the marsh just mentioned, the grazing farmers would be ruined if they suffered so much grass on their lands. And it seems to be a bad practice to allow the grass in pastures to advance to such a state as to require being swept over by the scythe, though it may be right to do it under such circumstances, in order to prevent the greater injury that might otherwise be produced.

It appears extremely probable, indeed, that by permitting the grass plants to run up to seed-stems, the pastures may sustain vast injury, not only by the exhaustion of the soil that takes place during the efforts of the plants to form and fill the seeds, but in consequence of their whole vegetative powers being directed to that purpose, from their sending forth few or no leaves. This is extremely evident in all the coarser sorts of grass plants, and fully explains the utility of keeping them closely fed down, as by such means a more abundant grassy herbage is provided for the support of stock. There are various observations that seem to support this opinion. Thus, it has been recommended to stock pasture lands in such a manner as will keep the grass in a young succulent state; as in this way there is a benefit, by the whole of the produce being consumed, and at the same time the stems of the grass plants are prevented from seeding, which exhausts the roots and the lands; the soil is of course preserved in a better state of fertility, more shoots are thrown out, the sward is rendered more close, and a more constant verdure kept up. "The true principle of grazing," in the opinion of the same writer, "is to eat *all*, and particularly at those seasons when vegetation is rapid, that it may not weaken the turf and soil,



but, by keeping the grass in a young state, have the shoots more vigorous."

As for the purpose of feeding the larger sorts of neat cattle, it is necessary for the grass to have grown to a pretty full bite before they are turned in, and of course numerous seed-stems to be formed; it seems not improbable, but that the superior benefit of feeding with sheep may depend upon the circumstance of their eating more closely, and thereby preventing such effects from taking place.

In the stocking of pasture grounds the growth of the grass should be particularly attended to, and the proportion of stock adapted to it; care being always taken to have a full proportion during the summer months, from May to August; a proper reserve being then made for the winter season. In this business the farmer should be as careful as possible to neither over or under stock, as by either means he must sustain loss and inconvenience.

There is another point, in respect to the eating down of pasture-lands, upon which farmers differ very greatly in their opinions, each contending for the propriety of their practice on the ground of experience: this is that of giving the cattle, of whatever sort they may be, the whole range of the lands, however extensive, at once, or by having them divided so as to let them have the grass at different times in a fresh unbroken state. The question does not appear to have been examined in that view, or with that degree of attention which is sufficient to fully decide the matter; and there are obviously various circumstances, such as those of the inequality of grounds and stocks, which must continually operate against its being determined by the test of experiment. It should probably be divested of those advantages that may arise from the circumstance of inclosure, as drainage, shelter, water, &c. in order to be fairly ascertained, and be merely considered as to whether there may not be more economy or less waste in the consumption of the grass in one way than in the other? and whether it may not go further in feeding or fattening the stock in one method than in the other? As the animals will not, of course, remain upon the same spot, the difference in respect to the disadvantage that may arise from the trampling down and spoiling the grass in that way, must be pretty equal in both methods of proceeding. In the first mode there will, however, be more difficulty in proportioning the stock to the consumption of the herbage, as well as more trouble and inconvenience in tending it; which are circumstances of importance. In what regards the grass being eaten with greater freshness in one case than the other, it is obvious that the consuming the herbage in a divided state must have what little superiority there may be, as each time the cattle are let into a new piece of grass it will be perfectly fresh; which in the contrary case can only be so at the first putting the animals in, as they mostly trample over the whole before they settle to feed quietly on any particular part. But there are other points of more consequence that seem to favour the feeding pasture-lands in a divided state; such as those of the cattle not grazing so quietly in large herds as in such as are smaller; and where any disturbance happens, either from ac-



cident or necessity, the whole being disturbed instead of only a part. Besides, it is found, as has been shown above, that all sorts of stock, when duly proportioned to their pastures, thrive better in small than large numbers together, being less liable to tease and disturb each other.

The experience of a writer, who has examined grass husbandry with much minuteness and attention in different districts, would seem also, in some measure, to favour the same conclusion, while it shows the benefit of one sort of stock following another, as he advises that “in all cases where fattening cattle or dairy cows constitute a part of the stock; and where soil, situation, and water will admit, every range of grazing lands should have three divisions: one for the head stock, as the cows and fattening animals; another for followers, such as the rearing or other lean stock; and a third for being preserved in order to freshen for the reception of the principal stock.” And he is decidedly of opinion, “that whether the ground may consist of one, two, or a greater number of divisions, not a weed should be suffered to seed, or a tuft of stale grass to stand on it; but once, at least, in the summer season be levelled down by the scythe, as by such means weeds may be converted into nourishment, “and waste ground into after-grass.”

The practice of close feeding, as recommended above, may, in many cases render this unnecessary, and at the same time afford a superior advantage to the farmer.

The proportions of stock of different sorts that can be properly supported on any given space of pasture ground must vary according to the natural goodness of the soil, the properties of the grass, and the differences in the sizes of the animals. There is likewise another circumstance which should be attended to, which is the length of time the land has been in a state of sward, as new lays are seldom capable of carrying so much stock on the acre as those of the older kinds. It is also a point that ought to be attended to, that these lays should be stocked as much as possible with sheep. To give any statement of the number of animals that may be grazed on the acre would not only be useless, but be liable to lead the young farmer into error, as it must differ so greatly in the manner that has been just noticed. Besides, the proportion of different sorts of stock that is put upon the grazing lands, in different districts, will be seen when we come to speak of the manner of feeding or fattening animals at grass.

Lands employed for the purpose of pasture are frequently occupied by stock during the autumn and winter, as well as the spring and summer months: it is, however, only those of the very dry kinds that can be turned upon in the winter season, especially by heavy cattle; and it is probably, in all cases, a much better practice to confine that sort of stock wholly to the fold-yards at such seasons, as by suffering them to be turned upon the pastures there must be a great loss in the waste of manure.

It has been found an advantageous practice by some to shut up their pastures late in the autumn, according to the state of the grass and other circumstances, eating them down as close and evenly as



possible previous to the stock being removed, and keeping them perfectly free till they are wanted for ewes and lambs in the early part of the year, or for cattle at a later period, as when the first shoots appear in the spring, which from being intermixed with those of the autumn, are supposed to afford more nourishment for the support of the stock than when either of them are eaten separately.

In fields that are pastured by cattle care should be taken that all such plants as are hurtful to stock be completely eradicated, as much injury is often done by them to the cattle as well as the products which they afford. The plants most prejudicial in this way are those of the hemlock, henbane, nightshade and yew kinds. It has been observed, that while the grass is plentiful there is not much danger of their feeding upon such plants: but when it becomes scarce, and they are confined, it is likely to take place, especially in the spring season.

*Drinking-Ponds.*—There is another circumstance in respect to pasture lands that it is indispensably necessary to attend to, which is that of their being well supplied with water, as without having this in some degree at command, it is impossible that the stock can thrive well, or answer in the most perfect manner in other views. Where they are not therefore supplied by brooks or streams running through them, it will be necessary to have recourse to the forming of ponds, or pools, for the purpose in the fields. In situations where the natural stratum of clay is of considerable thickness, there is little difficulty in the constructing of watering ponds so as to be perfectly retentive; but in loose porous soils the business is not executed without considerable art and attention. Even in clayey lands, except the ponds be kept constantly filled with water they are liable to become leaky. This has been supposed to depend upon the cracking of the clay by drought, and the perforations of worms, the basons being converted by such means into a sort of filters. These inconveniences are of course to be guarded against in their construction; which are partly effected by the proper application and puddling of the clay as the work proceeds, and the use of a coat of lime below it. It is of great advantage, also, in preventing the clayey stratum from being injured by drought and the poaching of cattle, to have coverings of earth, coarse gravel, or small stones laid over the clay. The sides or parts of the ponds which are to admit the cattle to drink should be well sloped down, so as that they may enter with ease and the least possible injury to the bottoms of the ponds.

In respect to their situation, it is the most usual to make them at the bottoms of slopes or rising grounds, where after heavy rains a slight run of water may be conveyed into them, from some road or other firm surface; many are, however, placed without any such assistance for filling, or with very little, it being found that the rain that falls upon their surfaces is in general sufficient for a supply, after they have been once filled: but in many cases, as the expense is considerable, it would seem more advantageous to have them formed in the angles or corners, where two or three fields meet, as by this means one pond may serve the whole, and at the same time but little space of ground be taken up or wasted. It has been suggested



as highly useful in the forming of these drinking-ponds, to have a waste water place on the upper side of the main reservoirs, to prevent their being uselessly *silted* up when full, by the muddy water continuing to run into them; as by its changing from a running to a stagnant state a considerable deposit takes place, which might thus be avoided. Much mud would also be collected in this way, in many cases, and be removed with little trouble; which renders them of great utility in procuring manure.

It has been observed that “the best season for making these ponds is thought to be in autumn, as they are then likely to be filled the soonest, and the least liable to crack before they are filled. Should the weather prove dry at the time they are finished, it is well to cover their surfaces with straw, or litter, to hinder them from “cracking.” And “as it is desirable to get them filled as soon as possible after they are finished, snow is frequently collected and heaped upon them, if possible, in large quantities, the first winter after they are finished for that purpose.”

The form of ponds for this use is in general that of a shallow basin, the sides shelving in a gradual manner from the brim to the centre. But other forms may be adopted according to circumstances. In the first mode, where the excavation is sixty feet in diameter, the greatest depth is about seven; but when only forty feet in diameter, the depth is mostly about five, before any of the coats are applied. There would seem, however, to be an advantage in having such ponds of greater depths and less diameters, as it is well ascertained that the quickness of evaporation is in a great measure in proportion to the extent of surface that is exposed to the influence of the atmosphere: of course such ponds as have great diameters with little depths, must become dry in hot seasons much more quickly than where the contrary is the case.

In setting out ponds of this sort, the use of the *level* will be necessary; stakes being driven down as a guide to work by in forming the banks, and in making the conducting channels and waste-water pools. The materials raised from the excavations must be taken away or applied according to the circumstances and situations of the land; but wherever these sorts of loose materials are employed, great care should be taken to have them well wrought together, in order to give them due solidity.

The expense of forming ponds of this kind must vary greatly according to the situations, the nature of the soil, and various other causes. They are “usually made by men who go about for the purpose, and are chiefly, or entirely, engaged in it, and who usually contract for the job. One of the diameter of sixty feet and depth of six feet, may in most situations be executed for about 15*l*.:” and “one of forty-five feet by five feet, for 10*l*. or 12*l*.; but some allowance must be made for the different prices of lime, and the distances it may be necessary to convey it, as well as the clay, or the other materials for the work. A pond of sixty feet diameter by six feet deep, will contain upwards of 700 hogsheads of water; one of forty-five feet by five feet, near 400 hogsheads—a vast supply when obtained at so small an expense.”



Mr. Marshall, in his *Rural Economy of Yorkshire*, where the subject is fully considered, has calculated the expense of each square yard of coated surface to cost from sixpence to sevenpence half-penny; which at present would probably cost ninepence or tenpence.

In speaking of farms on the Mendip hills, Mr. Billingsley, in the *Agricultural Report of Somersetshire*, also mentions a method of constructing drinking pools for cattle by means of mason's work, as on such elevated regions springs are seldom to be met with. Such skill is displayed in the forming of them that they scarcely ever let the water through or prove leaky.

In cattle-drinking ponds, it is a circumstance of great importance to the health of the animals to have the water as pure and free from impregnations as possible; but it is extremely difficult to provide it in such a state except where the water is in constant motion: something might probably, however, be done, especially where waste water pools are provided, in rendering the water more pure, by having it, in its passage to the large reservoirs, percolating through a sufficient body of coarse sandy or gravelly materials so confined as to prevent their being carried away.

*Cow-keeping.*—This is a practice from which much profit and advantage may be derived in particular situations and circumstances, as where the land lies near large towns, and is highly fertile and productive in good herbage; and where, in addition to this, the farmer has the means of conveniently providing various other sorts of food; either of the succulent, green, or other kinds. But to undertake this sort of management under the contrary circumstances could only terminate in loss and disappointment.

But besides these, there are other circumstances to be regarded, in the conducting the business of a milk-dealer, such as those of providing cows that afford the largest possible quantity of milk in proportion to the food they consume. This is a point that does not seem to have been much subjected to experiment, though the profits of the farmer must in a great measure depend upon it, as where such cows are employed as do not answer in this view a daily loss must be sustained. As this sort of farming is in most cases, as has been observed, only capable of being carried on with advantage in situations where the food is of the most rich and suitable kind, and capable of being provided in sufficient proportion to feed the animals in a plentiful manner, it would appear not improbable but that the large breeds may in general be the most proper for the purpose. But when attempted in other circumstances, where the food is neither so good in quality nor able to be provided in such abundance, breeds of a smaller description may be preferable, as it can never answer the farmer's purpose in this, or probably any other view, to have the cattle disproportioned to the nature and quantity of his keep. The inclination or tendency to feed in animals for this use is likewise a circumstance to be attended to by the cow-farmer, as where it is discovered to prevail they should be rejected as improper; it being found from experience that such cows as possess this property seldom or ever afford much milk. The disposition of



cows has also some influence in respect to the quantity of milk which they may afford, as such as are mild and gentle in general milk much better than where the contrary is the case.

The sort of cow most adapted to the intentions of the milk-farmer must of course vary, according to the nature of his situation and the means which he possesses of providing food. Under the first circumstances, the large short-horned, or Holderness breed, may commonly be the most advantageous; but in the latter, the long-horned, the Suffolk, Polled, and the Alderney breeds may be more profitable. There are likewise other breeds of the smaller kinds that may be found beneficial in these cases\*. It has, however, been suggested as not improbable, but that though the large breed just mentioned may at first, while there is a full supply of green or other juicy food, afford a very large quantity of milk, the smaller sorts continue to give a more regular quantity for a greater length of time.

Whatever the breed of cows may be that is employed by the milk-farmer, he should constantly choose such as are wide in the horn, thin in the head and neck, the dewlap not too pendulous, the carcass deep and flattish, wide (rather pointed) hips, buttocks round and fleshy, legs thin, with short joints; the udder capacious, not fleshy, but extending well backwards, the milk-veins large and prominent, and the teats long and large. A tame and gentle disposition is also, as has been shown, a circumstance of importance. The beauty of form is therefore never to be attended to in providing cows for the supply of the milk-dealer. It is chiefly the quantity of milk that is to be regarded; of course, all such cows as do not afford a *full* supply should be disposed of as soon as possible, as being very unprofitable in this sort of management.

Cows mostly come into milk about the third year of their age, and are in full milk at the fifth, and they may be continued to the eighth or tenth, according to circumstances. But in the practice of cow-keeping, from the high manner in which the animals are kept, it is necessary to change them much more frequently. With respect to the exact length of time that they may be continued as milkers with the most advantage, it does not seem to be well ascertained by experiment; but it is probable that it cannot be more than two, three, or four years at the most, though much must undoubtedly depend upon the constitution of the animal. It is the best, however, not to keep them too long, as the vigour of secretion is much less in old than young animals; and besides, they become more liable to swellings and indurations in the udders, as well as other diseases.

The age of cows is readily known by their shedding the tips of their horns at three years old, and the first rings commencing at the bottoms of them at four.

The cow-keepers in the county of Middlesex almost wholly employ the large Holderness breed, which are brought from a district thus denominated in Yorkshire, as well as others in the same neighbourhood, where the most perfect of this kind of cows are met

\* See Dairying.



with. It is observed that the dealers in this sort of cattle buy them of the breeders when they are three or four years old, and in calf, exposing them to sale afterwards at the fairs and markets in the country, particularly near the metropolis, where there is a fresh supply from the country weekly, by means of which the cow-keepers are enabled to keep up their several stocks. Great numbers of cows are likewise bought in the above places in lots of ten or twenty, by private commission, and forwarded to the respective cow-keepers in the above neighbourhood. The prices were formerly from ten to fifteen guineas, but for the last two or three years have increased to sixteen or eighteen guineas, and are now advanced to twenty or more. The cow-keepers breed very few cattle, and those only from cows that give much milk, and with very little attention to the choice of the bull. Where keep is plentiful, the best season for purchasing these animals, in respect to price, is the autumn or the beginning of winter.

The length of time which cows go with calf is nine months. It is the practice with some to keep an account of the periods of their taking the bull; and where the stock is extensive this is of much advantage, as it not only enables the farmer to calculate with more certainty on his supply of milk, but to have proper attention paid to them before as well as at the time of their calving; which is of much benefit to the animals.

There is a difference of opinion in regard to the distance of time they should become dry before their calving, some contending that they may be milked almost to the time of their dropping the calf without injury; while others maintain, that it is absolutely necessary that cows should be laid dry, from one or two months, both for the advantage of themselves and their calves. It is probable that much in this business must depend on the manner in which they are kept: as where they are well fed they may be continued in milk till within a week or two of their calving, without suffering any injury whatever from it: but in the contrary circumstances it may be better to let them run dry for a month, six weeks, or more, according to their condition, in order to their more fully recruiting their strength. It appears, however, not improbable, but that the longer the milking is continued the more free the cows will be from indurations and other affections of the udder; which is a circumstance deserving of attention. Where only one or two cows are kept for the supply of a family, it is likewise useful to know, that by good feeding they may be continued in milk, without any bad consequences, till nearly the time of calving. We have tried this method several times, without perceiving the least possible injury to arise from it. And in the Agricultural Survey of the West Riding of Yorkshire it is stated, that no advantage was found on trial to result from allowing the cows "to go dry two months before calving." They have there been kept in milk till within ten days of the time of dropping the calf.

Where cows are kept in any great number, it is always an advantageous practice to keep bulls along with them, as by such means they not only take them more readily, but are prevented from its



being omitted through inattention; which is otherwise often the case. Besides, the great trouble, inconvenience, and loss of time in driving them to a distance, is avoided. From twenty to five-and-twenty or thirty cows are sufficient for one bull. They shew their inclination for taking the male by riding upon the other cows.

After three or four months, cows may be ascertained to be in calf by pressing upon the off flank with the hand, as where that is the case the calf is found to strike against it.

They are shown to be near calving by their springing at the udder and the bearing: the former becoming more fully distended with fluid, while the latter is larger and more swelled out. Heifers, or young cows, are said to spring the soonest at the bearing, and those of the older kinds at the udder.

From accident and other causes, it sometimes happens that cows *slip* or *slink* their calves before they are sufficiently grown. Where this occurs, it is essentially necessary to remove such cows immediately from the cow-yards, or from mixing with the other cattle, for a few days. But where cows are much subject to such accidents it is the best method to get quit of them as soon as possible, as they will seldom turn out profitable.

In two, three, or four days, according to circumstances, after the cows have calved, it is the practice of the London cow-keepers to send the new-dropped calves to be sold, as they would not be saleable before. The cows are thus left in full milk from within a few days of the time of their calving. But in other situations that cannot always be the case, as the demand for suckling-calves is less; they must therefore be often suckled by the cow-keepers.

Where it is not the practice to bind up the cows in houses for the purpose, especially during the winter season, which seems by much the best method, warm well-sheltered yards, with open sheds, should be provided, in order to protect the animals, and prevent their being exposed to the weather, as by such means they will afford much larger supplies of milk than where they are left in a state of exposure to wet and cold in open dirty yards, as is often the case. The bottoms of yards for this use should be well laid with some sort of hard materials, and the dung be frequently scraped off them, so as to keep them as dry and clean as possible. They should also have plenty of good clean water to drink of at pleasure. If due attention be not bestowed in these respects, which is seldom done, it is impossible that the advantages that might otherwise be the case can be derived from them.

In the feeding of the animals it has been observed, that care should be taken to keep them constantly in good condition, as where they are ever suffered to become very lean, and that in the winter season, it is impossible to suppose that they can be brought to afford a large quantity of milk, by getting them into perfect condition in the summer months; as where cows are lean at the period of calving, no management afterwards is ever capable of bringing them to afford, for that season, any thing near the proportion of milk that they would have done if they had been supported in proper condition.



during the winter. Food of the most nourishing and succulent kinds should therefore be regularly given, in suitable proportions, in the cold inclement months, and the animals be kept warm, and well supplied with pure water, in the way just mentioned. Some advise their being cleaned by combing and other means; but this is a practice which, though useful in making them yield their milk more freely, can perhaps seldom be employed on an extensive scale.

In this sort of business the cow-keepers find great advantage in keeping the animals constantly fed with different kinds of succulent food, such as brewers' grains in a fresh unfermented state, turnips, cabbages, green tares, fresh cut grass, and soft green rye, or hay that has undergone little or no fermentation in the stack: by this means much juicy matter is thrown into the system, and a continual varied stimulus kept up, by which a large increase of milk is produced. As the different articles thus employed must have less effect in exciting the secretory organs of the animals, in proportion to the frequency of their use, the utility of varying their food as much as possible is rendered sufficiently obvious. On the same principle there are probably various other substances, as well as these, that might be made use of with great benefit; but too few experiments have yet been made with them, in this view, to lead to any useful conclusions. There is another circumstance, however, that deserves the attention of the milk-farmer in the feeding of his cattle, which is that of the dry food being properly proportioned to that of the green or rich succulent kind, as, where this is not well attended to, the cows, by being kept in too lax a state of their bowels, from the great tendency which such materials have to run off in that way, may afford a much less quantity of milk than would otherwise be the case. We know, from repeated experiment, that considerable loss sometimes takes place in this manner. In the foddering of the cows regard should also be had to supply them with the food in such a way as to excite the secretions in as regular a manner as possible. In this view too much food should never be given at one time, but supplied more frequently, as three or four times, or oftener, in the course of the day. This practice will likewise have an advantageous effect in having the fodder more cleanly eaten up.

The method of giving cows their food by the milk-farmers in the vicinity of the metropolis, where this business is carried on upon the most extensive scale, is thus stated in the valuable *Agricultural Survey* of that district: "During the night the cows are confined in stalls; about three o'clock in the morning each has a half-bushel basket of grains; when the milking is finished, a bushel basket of turnips is given to each cow; and very soon afterwards they have an allotment, in the proportion of one truss to ten cows, of the most grassy and soft meadow hay, which had been the most early mown, and cured of the greenest colour. These several feedings are generally made before eight o'clock in the morning, at which time the cows are turned into the cow-yard. About twelve o'clock they are again confined to their stalls, and served with the same quantity as they had in the morning. When the afternoon milking, which continues till near three, is finished, the cows are again



served with the same quantity of turnips, and about an hour afterwards with the same distribution of hay as before described. This mode of feeding generally continues during the turnip season, which is from the month of September to the month of May. During the other months of the year they are fed with grains, cabbages, tares, and the foregoing proportion of rouen, or second-cut meadow hay, and are continued to be fed with the same regularity until they are turned out to grass, when they continue in the field all night; and even during this season they are frequently fed with grains;” which are kept sweet and eatable for a considerable length of time, in the following manner: this is by depositing them in vats, or pits, below the surface of the ground, treading them tightly down into them, and then covering them over with a layer of earth, so as to prevent the air from coming in contact with them, and thereby producing fermentation. In this way they may be continued in a perfectly sound state from the month of March till the summer, when the brewing is discontinued. They are also capable of being preserved when well trodden down into casks or tubs, which have perforations in the bottoms for the purpose of draining off the superabundant moisture; these should be raised to some height from the ground by pieces of timber. In country situations it will seldom be necessary to preserve them in this way, as they will chiefly be wanted in the winter season.

Near Leeds in Yorkshire, the milk-dealers, in some instances, feed their cows with cut grass in the summer season, and brewers' grains and oat straw in the winter. And in the vicinity of Sheffield the “most experienced cow-keepers give five hundred weight of linseed dust mixed with three hundred weight of bran per week to six cows; others give a quarter of a peck of beans, with a peck of grains, for one feed for one cow, three times a day.” These are probably too expensive methods to be generally adopted; but as they are found to answer well, they may be employed with advantage in particular situations. It is remarked in the *Agricultural Survey of Middlesex*, that “some cow-keepers have tried salt mixed with the grains, more with a view to preserve the grains longer in a sound state, than from any consideration as to the health of their stock, or the improvement of the quality of the milk. It is acknowledged that the cows eat the grains so mixed with great avidity; but the proprietors not getting an adequate return for their trouble and expense, it is not found that it is now much practised.” It has, however, been contended, that the mixing of common salt with the food of cows not only improves the quality but increases the quantity of the milk, and at the same time is serviceable to the health of the animals; but accurate experiments are wanting to fairly determine the question.

The observations of Baron D'Alton on the management of these animals go to prove, by various accurate calculations, that a greater profit is capable of being derived from the keeping of them in the house than in the usual method of allowing them to feed in the pastures. And the author of the *Agricultural Survey of the West Riding of Yorkshire* has remarked, that by keeping cows upon red



clover and rye-grass, tied up in the house in the day-time during the summer season, and putting them out after milking in the evening for the purpose of air and water, one acre of clover has been found to go as far as two when pastured; besides a larger quantity of milk afforded. The large portion of rich manure that is made in this way is supposed to compensate any additional trouble or expense that may be incurred in cutting and conveying the food to the yards. In this method of keeping cows, as well as those with grains and other sorts of succulent food, it is constantly necessary, for the reason that has been mentioned, to combine some sort of dry meat, such as hay, straw, or other similar materials, with the grasses. In soils where lucern can be grown to advantage, it may be made use of with more benefit than the above; and by combining other sorts of green juicy food with either of them, it seems not improbable but that a still greater profit may be produced. Of the superior advantage of keeping milch cows in this method there can be little doubt, when considered in different points of view.

In the milking of cows more attention is probably necessary than has hitherto been bestowed upon the subject, in order to obtain the greatest possible quantity of milk. On the physiological principle of the secretions of animals being increased in proportion as the secreted fluid is more frequently withdrawn, it has been recommended to have recourse to more frequent milkings in order to augment the quantity of that fluid in cows. And there can be little doubt but that by accustoming the secretory organs to a more frequent secretion, such a habit may be established in them as will afford a larger proportion of milk in a given time. But in order to effect this in the most perfect manner, it will be necessary to have the cows highly fed, and to observe the greatest regularity and exactness in the periods of milking, and to be careful that every drop of milk is drawn away each time, as without due regard in these respects the desired effect will not be produced. This is fully shown to be the case by the few experiments that have been instituted with the view of deciding the matter; as while the cows were consuming the more juicy spring food, there appears to have been an increase in the quantity of milk both by three and four milkings in the day; but in the autumnal season there seems to have been rather a decrease under the same circumstances.

The method of milking adopted by the cow-farmers in most cases, is only to have their milking performed twice in the course of twenty-four hours. In such cases the most proper times would seem to be about seven o'clock in the morning and five in the afternoon; but in the neighbourhood of London and other large towns it is the practice to have this work performed from four to half past six in the morning, and from half past one to three in the afternoon. It is, therefore, probable that more frequent milking in the business of cow-farming, especially when conducted upon any extensive scale, would not only be inconvenient but impracticable. In such cases all that can be done is, perhaps, that of having the operation executed with as much care as possible, in respect to the whole of the milk being taken away each time, and by persons who are careful



and perfectly accustomed to the work. Where this is neglected, much loss may be sustained, not only in the immediate produce of the milk, but in the cows becoming much more quickly dry, as well as their being more subject to affections of the udder. The best advice is to have the business performed in an expeditious manner, in regard to the whole of the animals, and with the utmost attention in respect to cleanness. A sufficient number of persons should of course be employed in proportion to that of the cows. An expert milker is capable of performing the operation on from six to seven or eight cows in the course of an hour.

The profit or advantage of this method of farming must vary considerably, in proportion to the situation, in respect to the convenience of sale of the milk, and the facility of providing the animals with suitable kinds of food. It is a method, however, that requires fewer servants or attendants than most others in proportion to the extent of business; seldom more than four or five men being employed in the attendance of three hundred cows. The expense of milking is thrown upon the milk-dealer, who contracts for the produce of a certain number of cows. If this was not the case, the expense to the cow-keeper would be very high, as one woman cannot milk more than eight or nine cows twice in the day. In country situations this may, however, not always be the case. The cow-houses in Middlesex are mostly provided with milk-rooms, where the milk is measured and served out by the cow-farmer.

*Suckling of Calves.*—This is another method in which the produce of the cow may in particular situations be turned to great advantage. It is only, however, in the neighbourhood, or, within a certain distance, as twenty or thirty miles, of large towns, where the demand for veal is constantly great, that the practice can be attempted with success. In other circumstances it is by no means applicable, or to be depended upon by the farmer. Where the pastures are rich, and situated near the suckling-houses, it may be more advantageous than in other cases. In this business, as well as that of cow-keeping, the animals should be well suited to the nature and supply of food that can be constantly commanded. And as in the fattening of calves much depends both on the quality and quantity of the milk, those cows should be chosen for the purpose which, while they afford such milk as possesses rich and highly nutritious properties, may supply it in a tolerably large proportion. On these accounts the large Helderne breed of cows may often be less proper for the calf-suckling farmer than those of other breeds that do not afford milk in quite so large a proportion, but of a superior quality. Where the pasturage, however, is good, and the command of other sorts of food easy at all seasons of the year, the larger breeds may be employed in this way with great profit. It has been advised by some, as the best method of obtaining a suitable breed of cows for the suckling business, to wean every year a proper number of calves from the best cows, which from their being raised where they are to be afterwards kept, and at a cheap rate, must be more advantageous than purchasing them from distant districts.

But whatever the breed of cows may be that are kept for this use,



they should be constantly well fed, either by grazing in the pastures or by being foddered in the stalls. It is mostly the practice to feed them in the autumn, the winter, and spring months, while tied up, with brewer's grains, turnips, cabbages, carrots, and various sorts of green food that are made use of for soiling cattle; to which a suitable proportion of well-made green rouen or meadow hay is added; and a full supply of pure water twice a day at least.

It is essential in this practice, that the suckling-house be spacious and airy, having a range of ties or fastenings on one side for the purpose of confining the cows, and on the other a set of cribs or pens for containing the calves. These should be so contrived, as, while they keep the calves as dry and clean as possible, they exclude them from the influence of the light. Some advise, in the first view, raised moveable floors formed of narrow laths or spars, nailed upon joists, at the distance of about an inch from each other, as by this means the moisture and nastiness are not only immediately drained off, but a considerable degree of ventilation effected\*. This method is probably, however, more necessary for calves in the state of rearing than those that are fattening for the butcher. In these cases it is mostly the custom to have only common floors. The pens or divisions should never be too large; as in this business the more quiet, and the less the calves move about, the better they fatten. And it is of the utmost consequence to have them kept perfectly clean, and free from every sort of disagreeable smell, as without attention in this respect the business never goes on well. This is best effected by frequent sweeping and cleaning them out, and having recourse to fresh clean wheat straw for littering them with every day. It is also a good practice to have collars made of leather to pass round the necks of the calves and buckle, as by this means they may be conveniently tied in the pens when necessary, and likewise be confined in their proper places while suckling, by fastening the lines that are fixed in the ceilings of the houses, for the purpose, to them. These contrivances not only save much labour, but prevent that confusion which would otherwise be the case. In this management one person is sufficient to the taking care of fifteen or twenty cows. Some, however, think it better not to tie them in the pens.

There are two methods pursued in the fattening of calves; one is by allowing them to suck the cows, and the other to give them the milk after it has been drawn from the animals. The first is obviously the most advisable practice, and that which is the most commonly followed. In this mode the calves are in general only admitted to suck twice in the day; but it would probably be more advantageous to let it be done three times, at as equal distances as possible from each other, as in this way the calves would be less liable to have their stomachs overloaded, and of course be less exposed to danger from scouring; and consequently fatten faster. In the latter method the milk is given them warm from the cow in the morning and evening, being gradually increased as the calves increase in



strength and size. This practice is more troublesome, and has only the advantage of keeping the cows more quiet.

The length of time which is necessary for perfecting the business of fattening must vary according to circumstances; but in most cases it is from six, or seven, to eight or nine weeks. Where this is not a regular business, the fattening is however generally dispatched in a much shorter time.

It has been suggested, that “as it is necessary that the calves should always lie quiet, in order that they may indulge in sleep at those times when they are not employed in sucking, the cow-house should be situated in the most retired part of the yard, and the pens should be kept as dark as possible. But notwithstanding this caution, the calves should by no means be suffered to lie too hot in the summer time; which would be apt to induce a sickness amongst them. To admit, therefore, an occasional draught of fresh air, let a window be cut in each pen, with shutters adapted to the same, and let these windows be opened whenever the closeness of the atmosphere indicates it to be necessary. In the summer season they should rarely if ever be closely shut; and when it is required, the stream of air may be increased by opening the cow-house door at the opposite end of the building.” And it is added, that “as the calves are brought forth they are to be taken into the pens, and suckled on their own dams, which at first will yield a far greater quantity of milk than is necessary for their offspring, so that another calf may be suckled thereon; or the cow may be milked, and the cream be reserved for butter, or applied to any other use that the owner may think proper. As the calf increases in size, it will require a larger quantity of milk; but whilst they are young, one good cow will yield a full supply for two calves; and when the whole produce is demanded for one calf, another new milch cow should be provided, and these two cows will abundantly supply three calves with milk till the oldest is fit for the butcher; after which, if necessary, a fresh suckler may be brought in, and the business be carried on progressively by keeping the house constantly supplied with calves, so that the whole milk may be sucked.” As the business of calf-suckling and dairying can seldom or ever be carried on to advantage together, it is always the best method to provide sucklers whenever they are wanted.

In most situations, within the distances that have been specified, the suckling-farmers supply themselves with sucklers from the London markets, as being the most convenient places to apply for them, so as to be on a certainty, as these are “the general receptacles where the milk-men vend their calves; and which having been bred from the larger sorts of cows generally turn out to good account for the suckler; such large-boned calves, when fattened, arising to a weight much more considerable than the ordinary produce of the country dairy-men; and as to the superior quantity of milk required in fattening the larger breed of calves, this is amply recompensed by the great increase of weight.”

As young calves when permitted to suck their fill are often seized with a looseness or scouring; in order to prevent this, for the first



fortnight or three weeks it is necessary to stint them in their allowance; but at the same time due regard should be had that they do not pine or decrease in flesh for want of milk. After this age they should be allowed to suck as long as they choose, and every means ought to be made use of to increase their appetites, and render them more eager after their food. Chalk may be made use of for this purpose, as well as for correcting the superabundant acidity in the stomach, and lessening the tendency to scour. The idea of its giving to the flesh a delicate whiteness is probably not well founded. Salt sprinkled in the troughs likewise acts as a stimulus to the appetite: besides these, it is a common practice with some to give their calves balls composed of flour, pounded chalk, and milk, with the addition of a small quantity of common gin, and sometimes a little tincture of opium. Of these balls they give two, about the size of a walnut, once a day, or oftener, to each calf. Such balls, being very nutritious, in some degree supply the place of milk, and at the same time, from the great stimulus which they afford to the young animals, dispose them to sleep, and thereby increase their disposition to fatten: but where milk can be had in sufficient abundance, it is never worth while to have recourse to these aids. When the demands of the calves, however, are beyond the powers of the cows, these balls come seasonably to their relief. Occasional bleedings have also been advised, to prevent loathing the food and diseases from plethora. In order that the calves may be provided with sufficient store of milk, the pastures should be changed whenever the cows are found to be deficient in this particular; and in the winter time they should be well fed in the manner directed above.

In this system of management it is constantly necessary to be buying in calves at a week or ten days old, or as they can be procured. The prices vary, according to the goodness and the time of year at which they are bought. In general sucklers fetch the largest price in summer, when veal sells the cheapest; and the reason is, the smaller number to be met with at that time than in the spring. A good suckler can seldom be bought for less than 20s. and is often sold for 25s. or 30s. They are kept till they fetch from four or five to seven or eight pounds. The business of suckling was formerly reckoned to turn out to good advantage, when each calf throughout its fattening brought a profit to the farmer of three shillings a week; but at present the profit on suckling is much greater.

The calves that are suckled by their own mothers are in general found "to fatten in a shorter time than those which are afterwards bought in to supply their places: the reason of which is, probably, their not having been removed from the place where they were first dropped, and having always continued to suck the milk most natural to them; which must be supposed more nutritious, and to agree better with them, than that of any other cow. Besides, from the cows having lately calved, the milk nourishes and fattens in a higher degree than when they become stale milched. Cow calves are observed to fatten more kindly than the male or bull calves; and these last are much more coarse grained, and their flesh less delicate in taste, than the former." In some districts, barley-meal, and linseed



boiled into a kind of jelly, and such-like materials, are sometimes given to calves in the course of fattening; but the above methods are greatly superior, though they may be more expensive.

It is found by experience that the veal of calves when killed at six weeks or two months old is seldom of so good a colour, or does the flesh of such young calves taste so well, as where the animal is suffered to live a few weeks longer. "To attain both these ends of colour and flavour, it is supposed necessary that the calves should be maintained with plenty of milk, and regulated under such management as before directed, till they arrive to the age of eight or ten weeks, according to the season of the year, the more or less kindly state of the calf, the particular demand of the markets, or other circumstances. In the summer season it may be proper to dispose of them at an earlier period than in the winter; not only on account of their growing away with greater celerity in warm weather, but likewise because of the increased demand for small veal, which is then most saleable. During the last three or four weeks, blood should frequently be drawn from the calf, which, it is supposed, will be a likely means towards rendering the veal of a colour delicately white; a circumstance so much attended to by the butcher, that he will commonly depreciate such calves as from the appearance of their eyes are likely to die *black*, as they term it, though in other respects not to be despised." It is probable, however, that the colour of the veal depends upon the breed, and is incapable of being altered in this way.

The advantage of this practice is very considerable when conducted upon a large scale. Near the metropolis the gross product of a cow in this way was, before the late advances in the price of butcher's meat, estimated to rise on the average to seven or eight pounds in those of the moderate kind, and in very good ones to nine pounds. The profit at present stands much higher.

*Rearing of Calves.*—This a practice that every farmer who is desirous of having a good cow stock should be careful in attending to, by selecting the best cow calves from such cows as are the most quiet, give the richest milk, are the most hardy, and most adapted to the comparative goodness of the farm,—and rearing them with every possible attention. There are different modes of conducting this business: but the most natural and convenient, as well as that which is most advantageous to the animals, is permitting them to suck for a sufficient length of time to get into perfect order before they are put to other food, as in this way they become much stronger, and more disposed to thrive, than where brought up from the first by the hand; and, besides, the trouble is infinitely less. The proper method would therefore seem to be, that of letting the calves be suckled twice or oftener a day for some length of time before they are weaned. But this is a practice that is not by any means general, different districts having particular methods, which they consider as the best.

In Yorkshire the usual method is, for the first two or three weeks, for them to get milk warm from the cow; but for the next two or three weeks half the new milk is withdrawn, and skimmed milk



substituted in its stead; and at the end of that period the new milk is wholly withdrawn; they are then fed on skimmed milk alone, or sometimes mixed with water, till they are able to support themselves by eating grass or other food of that sort. They are very seldom allowed to suck. But in Cheshire the practice is to allow the calves to suck for the first three weeks. They are then fed on warm green whey, or scalded whey and butter-milk mixed: with the green whey water is frequently mixed, and either oatmeal or wheat and bean flour added. A quart of meal or flour is thought sufficient to mix with forty or fifty quarts of liquid. Oatmeal gruel and butter-milk, with an addition of skimmed milk, are also used for the same purpose. Some one of these prepared kinds of food is given night and morning for a few weeks after the calves are put on that diet, but afterwards only once a day, till they are three months old or more. Calves in Gloucestershire are not allowed to suck above two or three days; they are then fed on skimmed milk, which is previously heated over the fire. When they arrive at such an age as to be able to eat a little, they are allowed split beans or oats and cut hay, and water is mixed with the milk. And the Sussex method is still materially different from any of these. It is common there to allow the calves either to suck for ten or twelve weeks, or to wean them at the end of three or four, and to give them a liberal allowance of skimmed milk for six or eight weeks longer. It is the custom in Suffolk to let the calves suck six or seven weeks, and then to give them coarse pollard and oats with skimmed milk and water, letting them have some nice green hay constantly till they are turned to grass. Carrots might likewise be used with advantage as a substitute for the oats. In Norfolk, with early calves, the method is for them to suck twice a day for a fortnight, then to have the pail twice a day for an equal length of time, afterwards once a day for a month or six weeks longer; cut hay, turnips, and sometimes other materials being put in the racks and mangers. The latter is an excellent food where they take well to it, as they require but little water with them. With this combination of milk and turnips the calves are generally found to thrive extremely well.

In Scotland they have two methods for rearing calves; the first is by giving them a pailful, containing about a gallon, of milk warm from the teat of the cow, morning and evening, for eight or ten weeks; and the second is to allow the calf to suck its dam.

Where calves are reared with skim-milk, it should be boiled, and suffered to stand until it cools to the temperature of that given by the cow, or a trifling degree more warm, and in that state to be given to the calf. Milk is frequently given to calves when made warm only; but that method will not succeed so well as boiling it. If the milk be given over cold, it is apt to cause the calf to *skit* or purge. When this is the case a little rennet may be put in the milk. If, on the contrary, the calf is bound, bacon or mutton broth is a very good and safe thing to put into the milk. From a gallon to a gallon and a half of milk per day will keep a calf well till it be thirteen weeks old. It may then be supported without milk, by giving it hay and a little wheat-bran once a day, with about a pint of oats.



The oats will be found of great service as soon as the calf is capable of eating them. The bran and oats should be given about mid-day: the milk in equal portions, at eight o'clock in the morning and four in the afternoon. But whatever hours are chosen to be set apart for feeding the calf, it is best to adhere to the particular times, as regularity is of more consequence than is commonly supposed. If calves go but an hour or two beyond their usual time of feeding, they find themselves uneasy, and pine for food. It is always to be understood, that calves reared in this manner are to be enticed to eat hay as early as possible; and the best way of doing this is to give them the sweetest hay that can be procured, and but a little at a time. Turnips or potatoes are very good food as soon as they can eat them; and they are best cut small and mixed with the hay, oats, bran, and other similar substances.

There is another mode that may sometimes be adopted, which is that of sacrificing the milk for the benefit of the calves, by letting one or more run with the cows in full milk till they are capable of providing for themselves, but this is a method that has been objected to, as not letting the cows take the bull; which is probably a mistake. The more rapid growth of the calves, and the great convenience of the method, are however greatly in its favour.

When the calf is suffered to suck the mother, it should have the first of the milk, the rest being afterwards milked. It will thus have the thinnest part, which is the least liable to injure it by producing a scouring. As calves are frequently subject to be affected with looseness from a sort of indigestion being produced in their stomachs, which, when it proceeds to any great length, is termed the *skit*, great care should be taken, especially where they suck stale milched cows, or when taken from sucking and put upon other food, to guard against this effect; which may in most cases be accomplished by not letting them have too much at once, and gradually accustoming them to the change. When this effect rises to the state of disease, the best remedy is probably that of boiling pounded chalk, in the proportion of half a pound or more to four quarts of water, adding a couple of ounces of the shavings of hartshorn, with a quarter of an ounce of bruised cassia, for a few minutes, and then straining off the liquid, which may be given with the milk or other food suitably warm, to the quantity of from half a pint to a pint, once or twice a day, according to circumstances. In these cases the calves should always be kept dry and warm under shelter from wet. If other materials be necessary to be mixed with the milk, wheaten flour will probably be found the best.

*Weaning of Calves.*—It is better in general to wean early than late, as calves that are weaned late in the season seldom rise to any great size. In January or February, and till the beginning of March, may answer very well, but, except where the largeness of growth is of no consequence, it should not be attempted later; however, under such circumstances it may be continued till the early part of May. The best mode of doing this is to let the calves have new milk at the beginning, afterwards a mixture of new and skimmed milk, then simply skimmed milk, and ultimately a mixture of



water and skimmed milk with a little barley or oat-meal, or flour stirred into it. A small lock of sweet hay is also to be kept tied up within their reach, to induce them to eat that sort of food as soon as possible. The calves are soonest learned to drink their milk or other liquid food by the dairy-maid putting her finger in the pail that contains these substances while they are feeding. When they are once taught in this way to drink, no further trouble will be necessary.

It is not absolutely necessary to continue the giving of milk after the calves are a month or six weeks old; but they are certainly the better for it when it can be done.

From the increasing scarcity of milk, great attention has lately been bestowed in discovering substitutes that may answer the purpose without that valuable food, as by such means a greater number of calves might be reared; which would be of vast importance to the farmer, as well as in other points of view. Various experiments have been instituted in this intention, but without any very complete success. It has been advised by Mr. Varlo to have recourse to a strong infusion of hay, made by pouring boiling water on good fresh hay, covering the vessel up closely during the operation, and letting it remain till the virtues are fully extracted; with the proportion of one pint of oatmeal, the same quantity of flax seed, and a quart of skimmed milk; the flax seed being bruised and put in with the hay, and the meal and milk added afterwards to the clear infusion. In this way, it is contended that a bushel of flax-seed, worth about three shillings, will be sufficient for rearing two calves. A similar method has been attended with success for young calves that have been kept with milk in Lincolnshire; but in this case the bruised flax-seed is boiled to a kind of jelly of light consistence, which, after being sufficiently diluted with warm water, is then rendered of the thickness of cream by barley meal being stirred in. When a great number of calves are to be reared, and the supply of milk is inadequate, by being used in combination with this composition it may be made to support nearly twice the number of calves. The advantage that may be derived in this way has not however been fully ascertained by accurate experiments. A method recommended by the Duke of Northumberland was found to succeed well in his trials, and those of others since. It is by preparing skimmed milk with other ingredients, so as to answer the purpose where new milk is given, at about one-third the expense. The substances that are made use of are treacle and linseed-oil cake, reduced by the operation of grinding to the state of almost an impalpable powder; being employed in such slight proportions as, exclusive of the milk, to come to no more than about sixpence for thirty-two gallons. The manner of preparing it is this: "Take one gallon of skimmed milk, and to about a pint of it add half an ounce of common treacle, stirring it until it is well mixed, then take one ounce of linseed-oil-cake, finely pulverized, and with the hand let it fall gradually, in very small quantities, into the milk, stirring it, in the mean time, with a spoon or ladle, until it be thoroughly incorporated; then let the mixture be put into the other part of the milk, and the whole be made nearly as warm as new milk when it is first taken from the cow." In this



state it is fit for use. “After a time the quantity of oil-cake powder may be increased.” This should be done as occasion may require, and as the calves become inured to the flavour of such food.

Mr. Crook has been in the habit of weaning calves with success without any milk, by making a jelly of one quart of linseed boiled ten minutes in six quarts of water, which jelly is afterwards mixed with a small quantity of the best hay-tea.

It seems not improbable, from the trials which we have made, that potatoe-meal may be used this way with benefit, as it mixes well with either milk, water, or weak broth, and is highly nutritious. By this means the great expense of oats, meal, and other similar substances may be avoided. There are many other substances that might prove useful in this intention, if proper trials were made with them.

In regard to the period of castrating or gelding the calves, it is probably the best to perform the operation pretty soon after they have been dropped, as there will be less danger from bleeding, and of their taking on too much inflammation, at that period than afterwards, when they have attained a greater degree of health and vigour. Some advise three weeks or a month, but a week or a fortnight at most is perhaps much better. In the male calves, the cutter, when expert, after dividing the scrotum, or bag, and separating the testicles, draws out the spermatic vessels, by introducing his fore-finger and thumb. It is probable, however, that simple excision may be equally effectual, and must always be less hazardous. The *spaying* of the female calves, which is frequently performed, is an operation of great nicety, and requires more dexterity in its management. Such calves as have been spayed are found from experience to be more quiet in the pastures, and afterwards to fatten more expeditiously.

Much care and attention is necessary, especially in the more early weaned calves, to keep them perfectly dry and warm, as their thriving will in a great measure depend upon this being effectually done. The substances, of whatever kind they may be, should be left off in as gradual a manner as possible, as the calves become incapable of supporting themselves on hay or grass. The following advice of a practical writer\* is judicious: After the calves have been weaned, especially the later ones, they should be turned abroad, in the day-time, into a small close or orchard near the farm-yard, where there is a good bite of grass; and, as there is generally more than one calf weaned in the season, they will each be company for the other, and become in a short time reconciled to their situation. This pasture should be at some distance from that whereon the dams are turned, and have neither ponds nor ditches, or any annoyance which may endanger the lives of these youthful animals; and in order to habituate them still more to their pasture, the food should be carried clean to them at each of their feeding-hours. For the first month or six weeks, they ought every night to be brought out of the meadow, and lodged in the pens; but, after this time they

\* Mr. Bannister.



may be left in the pasture as well in the night season as in the day: and their food may now be lowered by degrees, till it be at length reduced to simple water only; for, when the calves get to the age of twelve or fourteen weeks, they will no longer require the aid of this sustenance, but be able to satisfy their appetites by grass. Care, however, must be taken throughout the summer that they be frequently shifted from one pasture to another, in order that they may be kept up in good flesh, and enabled to grow away with the utmost celerity. At Michaelmas, or soon after, they should be taken into the yard; and if they were allowed the indulgence of a small close to themselves it would be still better. And here their taste must be gratified with the best and sweetest hay that can be procured, with an outlet on a dry pasture, where in fine open weather they may be suffered to enjoy themselves: it would redound greatly to their advantage, if, on the approach of winter, a shed was to be erected for them to repose in during the night, and for shelter in tempestuous days. So essential are warmth and good living to young animals of every denomination, that the care which has been taken of them in their early life will be manifest in every stage of their future growth. Nor is there any stock which will pay better for this cautious management in their youth than those of the cow kind; for if these are stinted in their feed, or carelessly attended whilst in their growing state, they will never arrive to that size which they would otherwise have done, and consequently the loss will be perpetually felt by the farmer who attempts to raise milch cows of his own breed without giving them a due attendance in the first year.

It is added by the same author, that “when calves have attained their first year they are called *buds* or *yearlings*; and though at this time they be able to mix with the herd, yet it would be most prudent, if not attended with too great an inconvenience, to suffer them to remain in a pasture by themselves. But if this cannot be done, let them be turned out with the dry stock, and not permitted to run with the cows, as this might probably be the cause of their taking the bull—a measure which should at this age be cautiously guarded against, as such *buds* as propagate at this early age mostly receive a check in their growth on this account: and if, during the succeeding winter, they were to be managed as before directed, their future growth would be found to pay ample interest for the fodder that is now given them: only this is to be observed, that as their strength is now considerably augmented, a less valuable fodder may suffice, and good pea-straw may supply the place of hay. Such farmers as have low rushy meadows, where there is frequently a length of old grass in the winter, may, in this second year, turn the calves into them, as they will meet with plenty of nourishing food, whilst the weather is fair and open.”

At two years old some suffer heifers to take the bull, and think it the best method; but others suppose it a better practice for the cows, and more to the interest of the farmer, to wait a year longer before they are put to the males, they will make much better cows by such a delay.

It is in all cases by much the best practice to feed the young cattle



stock both the first and second year, especially in the winter season, as well as possible; as when the contrary method is adopted, their growth is so restricted that they can afterwards scarcely be brought into a proper state of thriving by the best food: such as turnips; hay, with root food, carrots and potatoes, may be the most beneficial in the second winter, great care being taken to keep them clean by proper littering. When straw is the common food, such roots should be employed in a larger proportion. The two-year old cattle, whether of the male or female kind, should be fed with hay or good straw, accordingly as they can be more conveniently afforded, interposing feeds of turnips, cabbages, or other similar sorts of food. In general it may be a good rule to keep cattle of the same age and kind as much together as circumstances will permit; as by such means they feed better, are less liable to accidents, and are capable of being fed more properly, as they mostly require the least feeding while young.

*Dairying.*—There are some sorts of grass lands that answer better in this management than others. It is not well decided, though general experience seems to favour the opinion, that very fertile pasture lands may be more profitably applied to the purpose of grazing or fattening animals than that of dairying; but such as are not capable of bringing the larger sorts of cattle to a complete state of fatness, and which usually let from twenty to five and twenty shillings the acre, may be more profitably employed in this way. And most of the low and more moist kinds of meadow lands, which though the value may be high, as they do not succeed so well for the purpose of fattening, may be found highly useful for the dairy. The high, open, and exposed uplands are always less proper for this sort of practice than those which are situated lower, and are more inclosed and warm.

In the management of the business, the nature of the pastures and other sorts of food which the farmer has at command, must direct him in the extent and kind of dairying which he is to pursue.

Where the grass lands are of the older kinds, and tolerably rich and fertile, butter should probably, in general, be the principal object; but where they have been more recently converted to the state of sward, and are of a more cool as well as less rich quality, cheese may be the most depended upon. It is perhaps only under particular circumstances and situations that the different methods can be combined with profit and convenience. There are, however, cases in which this may be attempted with great advantage.

It has been an observation in dairying, founded upon long experience, that such lands as have been for a great length of time in the state of pasture afford milk that abounds more in the oily material or cream; while those which have been a less time in that state, and are of a more cold nature, are more productive in such milk as has the caseous matter in a large proportion to that of the cream.

In Yorkshire the dairy-farmers are, in many cases, in the habit of preserving their old pastures in their original state, as they find the milk produced on them churns with more facility, and the butter is



capable of being kept better than if such naturally rich grounds were highly improved. In some cases it has been found that there was great difficulty in making as well as preserving the butter, especially in the more warm months, where the land had been wholly ploughed up and improved by manure, particularly of the calcareous kind, where there was previously no difficulty of that sort, and the butter was of the best sort.

Old pastures have, therefore, besides the property of supplying the butyraceous material in greater abundance, that of rendering the butter more firm and waxy.

It has likewise been observed that the richness of the butter in the Highlands of Scotland has been universally attributed to the cows feeding upon the old grass in their remote glens, though it is suggested that this may partly depend on the management that is adopted in making it. In Cheshire they find that the inferior sorts of pasture lands are the best suited for cheese.

But though this may in some degree be the case, there cannot be any doubt but that good butter may be made, in many instances, where the cows are kept in new pastures; and that excellent cheese may also be prepared where the lands that are employed as pastures have been long in the state of herbage. Butter equally rich and good with that made while the cows were grazed on the rich old pastures, has indeed been known to be sometimes prepared when they were fed with cut clover and rye-grass in the stall.

In commencing this sort of business, the farmer is, therefore, as has been just observed, to determine, from the nature of his land, the situation and other circumstances, which sort of dairy management it may be the most proper and advantageous for him to adopt, whether that of the cheese or butter kind. It has not been shown, by any set of experiments that can be fully depended upon, whether the butter or cheese dairy affords the largest profit to the farmer, when conducted under equally good management. The most valuable part of the milk is in such case converted into a substance of great utility; and though the former sells for a considerably higher price than the latter, from the differences in the quantity of the products, in the expense and trouble of management, and various other circumstances, it seems that the real advantages are nearly equal. It has been stated, before the late rise in the prices of these different articles, to amount, whether of butter and butter-milk, or of cheese and whey, to nearly fourpence-halfpenny for each gallon of milk; at present, perhaps, little less than from sixpence to sixpence halfpenny.

In the vicinity of large towns, and wherever butter is constantly in great demand, it may, however, be more profitable to have a butter dairy instead of that of the cheese kind.

It is obvious that much of the profit in this sort of management must constantly depend upon the care and assiduity that is bestowed in conducting the different processes of the business. And it has been observed that this kind of management should only be undertaken by those who are capable of paying the most minute attention to every department of it; as, unless this becomes a fixed and esta-



lished principle in the farmer's mind, the chance of success is precarious and uncertain. To trust wholly to common servants, in this sort of business, is always hazardous, and never to be practised where it is carried on to any extent.

The first thing that is necessary is that of being provided with a sufficiently large and convenient dairy-house, whether the object be cheese or butter. It should be so proportioned to the number of cows, as that there may be sufficient convenience for performing all the necessary operations without embarrassment; and much attention must be paid to cleanliness in every thing that relates to it, such as the shelves, floors, and different implements which are made use of, by daily scalding, scrubbing, rineing, and drying, in order to prevent any sort of acidity taking place; as, without due regard in these respects, it is impossible that the produce can be of superior quality, or such as will keep sweet and good for any length of time, &c. Cleanliness may indeed be said not only to be necessary in dairy-husbandry, but to be the foundation of it, and the most essential and most indispensable part of good management. It is observed that "a farmer may be in possession of the most valuable breed of cows, and these may be fed on the richest pastures; but unless cleanliness prevail in the dairy, his butter or his cheese will never stand high in general estimation." Next to the size and situation of the dairy-house, and to keeping it and the utensils clean, is that of skill and attention in the general management. In short, without a knowledge of the best modes proper to be adopted under different circumstances, and a regularity, method, and prompt attention to their execution, it is obvious that the business must soon run into confusion, and become unprofitable.

The necessary apparatus, such as churns, milk-pails, cheese-cloths, trays or pans, brass milk-kettle, and boiling copper, &c. exclusive of the cheese-press, for a dairy of twenty cows, will cost about fifty pounds. For fuel, either coal or wood will answer, but faggots preserved in the stack one year are the best.

The next circumstance is that of providing cows of the most proper kinds, according to the method of dairying that may be practised. It has been found by long experience, that some kinds of cows give milk of a much thicker consistence and richer quality than others; and that this richness of quality is not necessarily connected with the smallness of the quantity yielded by those of nearly an equal size; it is therefore of consequence to the owner of a dairy to be peculiarly attentive to this circumstance. In choosing cows for the purpose of butter, it ought rather to be the quantity and the quality of the cream produced from the milk in a given time, than the quantity of the milk itself, that ought to be regarded: this is a circumstance of more importance than is generally supposed; but where cheese is the object of the dairy, quantity of milk as well as goodness should probably be attended to.

In comparing the milk of two cows, in order to judge of their respective qualities, particular attention should be paid to the time that has elapsed since their calving; as the milk of the same cow is always thinner soon after calving than it is afterwards, as it gra-



usually becomes thicker, though generally less in quantity, in proportion to the time the cow has calved. The colour of the milk, however, soon after calving is richer than it afterwards becomes; but this, especially for the first two weeks, is a fault in colour that ought not to be regarded.

On the richer and more fertile pastures it is probable that the large and middle breed of cows may be the most beneficial, especially where both cheese and butter are made; but in such as do not possess such a high degree of fertility, the middle and smaller breeds may prove more profitable to the dairy farmer. Some suppose the long-horned breed not well suited for the dairy; but experiments that have been carefully made show, that more cheese may be produced from the same quantity of milk in that breed than in those of the short-horned, as well as more butter from the same quantity of cream. And in Ireland the Craven breed afforded more butter than the Holderness. Of the smaller breeds, the Alderney, the Suffolk polled, and the Kiloe or Scotch breeds may be found the most profitable. In the dairies of the Isle of Wight, as well as those of some parts of Hampshire, the Alderneys prevail much, and are highly esteemed for butter. Two-thirds of the Suffolk polled breed and one-third Alderney have been recommended as constituting an excellent dairy, the milk being mixed.

But besides the milk there is another object to be attended to in forming a cow stock, which is, that they be sufficiently hardy for the situation. In this respect the long-horned breed is much superior to the short-horned cattle, from the difference in the thickness of their hides: and the Scotch is probably better than either. This breed and the long-horned are therefore the most proper for bleak, exposed situations. As many of the mixed breeds afford excellent milkers, and in most of the genuine breeds there are great differences in the individuals, it may be the best mode, in order to establish a good dairy, whether for cheese or butter, for the farmer to breed from such cows, of whatever kind they may be, as he has found from experience the best for the purpose, without being at the trouble of purchasing the more expensive breeds. In this case good bulls should always be procured, as much is supposed to depend on the male.

In order to produce abundance of milk, and of a good quality, cows must at all times have plenty of food. Grass is the best food for this purpose, and that kind of grass which springs spontaneously on rich dry soils is the best of all.

In the winter keeping of the cows, there are different methods in use: but in the southern parts of the island they do extremely well in warm sheltered yards, with open sheds, especially when plenty of litter, such as straw, stubble, fern, or other similar materials can be afforded for keeping the whole well bedded. In the northern districts, however, and wherever a proper supply of litter cannot be obtained, it is better to have them tied up in stalls, with raised standings, and sunk paved floors immediately behind them for receiving the dung and urine, as by these contrivances they may be kept perfectly clean without litter, and at the same time be more



warm, as two cows may be confined in the same stall. The stalls should be kept constantly cleaned and well swept out.

In the summer management of the cows it has been observed that, “if the temperature of the climate be such as to permit the cows to graze at ease throughout the day they should be suffered to range on such pastures at freedom, but if the cows are so much incommoded by the heat as to be prevented from eating through the day, they ought in that case to be taken into cool sheds for protection; where after allowing them a proper time to ruminate, they should be supplied with abundance of green food fresh cut for the purpose, and given to them frequently, in small quantities fresh and fresh, so as to induce them to eat it with pleasure. When the heat of the day is over, and they can remain abroad with ease, they may be again turned into the pasture, where they should be allowed to range with freedom all night during the mild weather of summer.”

Cows are in general only milked twice a day; but, when “abundantly fed, they should probably be milked three times a day during the whole of the summer season: in the morning early, at noon, and the evening just before night-fall. For, if they be milked only twice in twenty-four hours, while they have abundance of succulent food, they will, as has been observed, yield a much smaller quantity of milk in the same time, than if they were milked three times. “In the choice of persons for milking the cows, great caution should likewise be employed; for if that operation be not carefully and properly performed, the quantity of the produce of the dairy will be greatly diminished. It should be a rule never to allow this important department to be intrusted without control to the management of any but very trusty servants; as the cows should always be treated with great gentleness.”

It has been observed to be of great consequence to the produce of a dairy, that the cows should not drop their calves too early in the season. When that happens, they fall off in the quantity of milk in the autumn, when, owing to its superior richness, it is more valuable than at any other period. From the end of March to the end of April is the best time in the more northern districts that a cow can drop her calf, as she soon gets into good condition on the early grass, and yields a greater quantity of milk in the course of the season than those that calve either considerably earlier or later. But in the southern parts of the island it is an advantage for them to calve much earlier.

In the management of cows during summer there is a sameness in almost every district. They are usually kept on the oldest pastures on the farm: when these are at a distance from the farmhouse, they are milked on the pastures; but otherwise they are brought home morning and evening for that purpose.

In winter the dry cows, that is, such as do not give milk, are fed on straw in the straw-yard; while those that are in milk, or are near calving, are kept in some inclosed pasture, or in sheds erected for the purpose, and maintained chiefly on hay. Where artificial grasses, turnips, cabbages, or potatoes, are cultivated on a large



scale, the milch cows have a daily and regular allowance of one or other of these sorts of food during the winter and spring months. Potatoes in particular are admirable food for cows; as, while they tend to keep them in good condition the quantity of milk is generally abundant and of good quality, both in respect to richness and flavour. In short, the dairy farmer, in every part of the island, will find it for his interest to be attentive in feeding his cows.

These different sorts of food may be distributed for summer and winter in this manner:—In summer *red clover, saintfoin, lucern, burnet, and tares* may be made use of with great advantage. But in employing the first, great care should be taken to guard against injury either to the animals, or the butter or cheese being rendered of a bad kind or flavour by it. On poor chalky hills the second will be of the greatest importance to the dairy farmer. Lucern and tares should always be employed in the way of soiling; in which method, where the cows have proper shade and sufficient water, they will be found of the utmost use, as they afford a very certain supply of food and go a great way. Besides, the cows are found to milk well in this management where proper attention is bestowed in the foddering of them. Some suppose it a method that can hardly be too strongly advised. In Mr. Baker's experiments, a middle sized cow was found to consume in the proportion of from 90 to 100 pounds of green lucern in the course of twenty-four hours.

For winter, *hay, straw, cabbages, turnips, carrots, potatoes, cole, malt-grains, &c.* may be made use of. The keeping cows with hay is in general too expensive to afford the dairyman an adequate profit: therefore, in order to lessen the expense of this sort of keep, other articles of the green root kind must be had recourse to: till near the period of calving they may be supported on fresh-threshed straw in cribs in the fold-yard, beginning with the worst and gradually proceeding to that which is of a better quality. Those in good condition should have the worst straw; but when it is not of the best kind, and the cows are of a valuable sort, they may be fed once a day with cabbages, turnips, or other similar sorts of food, in bins for the purpose. When within about a month or six weeks of calving, a little hay should be given at night, or the allowance of green food increased, and on the day of calving they should be confined, and have warm water; and for a fortnight after calving be very well fed with both hay and green food, in suitable divisions for the purpose. In this view the cabbages are extremely valuable, as the produce on the acre is large, and they afford much milk; but care must be taken to pick off all the dead and decayed leaves, which may be given to the young stock. A middle-sized cow will consume from one to two hundred pounds in a day, but seventy is supposed as much with straw as can be paid for by the produce. In Mr. Dodsworth's trials, a cow of fifty stone was found to eat twelve stone of this sort of food in the same time. An extent of this kind of crop proportioned to the dairy should always be provided. The only objection to turnips as food for milch cows is their impairing the flavour of the butter: but they are a sort of food that affords much milk; and without this, or the preceding green food, a large dairy



cannot perhaps be supported to much profit. A larger weight of this food than the former is consumed in the same time.

Carrots and potatoes are very advantageous sorts of food for cows where they are raised in great abundance; but even in such cases they can only be made use of with profit as a feed once or twice in a day with other sorts of food. It is out of the question that a cow could pay for being kept wholly on them. Cole, as being fed off in the field, can only be had recourse to on the firm dry soils; but in such situations it is a very profitable crop applied in this way, especially when used in succession to turnips in the spring months. Malt-grains, where they can be had in plenty, are useful with other sorts of food, as producing a large proportion of thin milk. They are consequently better for the purposes of the milkman than the dairy-farmer.

Whatever kinds of green or succulent food may be used in the way of feeding dairy cows, experience has shown that great advantage may be derived from varying it as much as possible, probably on the physiological principle that the novelty of stimulus is the most powerful in exciting the action and promoting the secretions of the system. The use of day and night pastures, which is a method employed in some districts, may also partly depend on this principle, and partly on that of better shade and water.

In the stocking of pastures with cows it should always be done according to their goodness: such grass lands as afford in rent, tithe, and taxes, twenty-seven or eight shillings, may support during the summer season in the proportion of a cow of fifty stones to an acre and a half with a few sheep. But in such as are not worth more than twenty shillings, one cow to two acres may be often fully sufficient.

In this management the rule should be for the pastures never to be too closely stocked.

In regard to the labour necessary in the management of dairy business, it will of course be different according to the difference of convenience and other circumstances; but a common dairy-maid can seldom manage more than twelve or fourteen cows in a perfect manner, especially where both butter and cheese are made. If she undertake more, she will require assistance in the dairy.

As the cows should not be more than an hour in milking, the maid cannot milk more than five or six; in a dairy of about eighteen cows two assistants will consequently be required at such times; which in summer, when two milkings only are practised, should be at five o'clock in the morning, and six at night. The work of the dairy must therefore be regulated in this proportion.

It is a good practice for the dairy-maid to constantly examine the cows separately after the milkers, especially when they cannot be fully depended upon; to see that the business has been perfectly performed; as, where the contrary is the case, loss may not only be sustained in the richest part of the milk, but the cows be more subjected to disease. This has been fully shown by Dr. Anderson in the Bath papers.

*Management of the Milk.*—The proper care of the milk, which is



the next circumstance to be attended to, is of the greatest importance to the success of the dairy. After being brought from the cows, it should be passed through a sieve or strainer of hair or silver wire, fixed in the bottom of a large wooden bowl into the vessels that are destined for its reception. But few experiments have hitherto been made with the view of deciding the most advantageous method of disposing the milk for the purpose of raising the cream in the largest proportion, and the shortest space of time: however, as the oily or butyraceous part of milk would seem to be diffused through the whole substance of the milk, and entangled among its particles, betwixt those of the serous and caseous kind, so as to be thrown up only in consequence of its possessing less specific gravity than the portion which is usually termed milk, from its becoming in a state of rest; it would seem that the most suitable method of placing it for the purpose of creaming well, and in the most expeditious manner, is that of very shallow pans, leads or trays, so as that it may not stand deeper than three or four inches at the most; as in this way there will not only be the least resistance afforded, but the greatest possible extent of surface for it to collect upon: by which means a larger proportion of cream is not only produced, but it is found from experience in the best dairy districts, that in consequence of the more expeditious cooling of the milk, the tendency to acidity in warm seasons is considerably checked and retarded. No trials have been instituted so as to decide what sort of material is the most appropriate and conducive to this end: it is probable, however, that wood or stone is much better than lead, as being not only more easily kept clean and sweet in consequence of their being less disposed to fur, but from their being more safe, on account of their not being acted upon by the acid of the milk.

There is another point on which further experiments are wanting, which is that of ascertaining the degrees of heat in which the different changes may take place with the greatest certainty and success at different seasons. From the few trials that have been made on this subject, it is believed that when the heat is from 50 to 55 degrees on Fahrenheit's thermometer, the separation of the cream from milk, which is the most important operation of the dairy, proceeds with the greatest regularity and in the most favourable manner. It is therefore thought that this will be found to be the temperature that ought to be aimed at: but it is not pretended to decide with precision; a considerable degree of latitude in this respect may perhaps be allowable: from the best observation it seems to be highly probable that when the heat exceeds 60 degrees, the operation becomes difficult and dangerous; and when it falls below the 40th degree it can scarcely be carried forward with any degree of economy or propriety. Till further experiments therefore ascertain the exact point, it may be taken as a safe rule, that the heat should be kept up, if possible, between the 50th and 55th degree; and in order to ascertain this, a thermometer, graduated by Fahrenheit's scale, should be hung up perpetually in the milk-house, to give notice to the owner of any alterations in the temperature of the air that may affect his interest.



It has not been yet shown, by any trials that can be fully depended upon, what is the length of time that the milk should remain in the pans or trays in order to afford the cream in the largest quantity before it is separated. Some suppose that this should depend upon the particular views of the dairy-man, and the degree of heat that is present at the period. In a moderately warm temperature of the air, if very fine butter be intended, it should not be allowed to stand more than six or eight hours. For ordinary good butter it may safely be let stand twelve hours, or more; but where the dairy is so large as to afford a sufficient quantity of cream, and where the very best butter is intended, (the milk being to be converted to some other use while yet sweet,) it may be separated after standing only two, three, or four hours. “In the general management of dairies milk is never skimmed more than once; but in the county of Essex, as well as some others, it is the common practice to skim it three or four times, or till no more cream arise. In the business of separating the cream from the milk there are two methods pursued, that most generally practised is to skim it off with a skimming-dish, made either of tin or wood. The other is adopted only where leads or cisterns are common, and where the milk is used for making skim-milk or two-meal cheeses; and, of course, before it coagulate, or acquire any degree of acidity. Toward the centre of the cistern there is a hole or pipe, which before the milk be put in is shut with a wooden stopper that rises several inches above the surface of the milk. When the milk is wanted for any of the purposes above-mentioned, a vessel is placed under the pipe, and the stopper drawn up so far as to allow the milk to run off, but so gently as that the surface of the cream may not be broken. The milk being thus gradually drained off, the cream sinks down till it at last rests on the cistern, when the vessel containing the milk being removed, and another placed for the purpose of receiving the cream, the stopper is entirely drawn out, and the cream drops into the vessel.” The first of these methods “requires a dexterity of manipulation that can be acquired by practice alone; but it is of great importance to the success of the dairy that it be well done; for if any part of the cream be left, the quantity of butter will be diminished; and if any part of the milk be taken, its quality will be debased.

When the cream has been “thus separated from the milk, it ought to be immediately put into a vessel by itself, to be kept till a proper quantity be collected for being made into butter, and no vessel can be better adapted for that purpose than a firm neat-made wooden barrel, in size proportioned to the extent of the dairy, open at one end, with a lid exactly fitted to close it. In the under part of this vessel, close to the bottom, should be placed a cock for drawing off from time to time any thin serous part of the milk that may chance to be generated; for should this be allowed to remain it acts upon the cream in a powerful manner, and greatly diminishes the richness of the quality of the butter. The inside of the opening of the barrel should be covered with a bit of close fine wire or silver gauze netting, to keep back the cream, while the serum is al-



lowed to pass ; and the barrel on its stand should be inclined a little forward in the top, to allow the whole to run off.

“ It is difficult to state any particular period for its being kept in these reservoirs before churning, so different is the management in this particular in different places. About Epping in Essex, which has been long in high repute for the superior quality of its butter, the cream is seldom kept above three, or at farthest four days,” but always till there is a certain degree of acidity in the cream, either natural or artificial, as without that they cannot ensure a good churning of butter : some keep a little old cream for this use, others use a little rennet, and some a little lemon juice. And it was the practice in a large dairy in Suffolk, which had a high character for making butter of a superior quality, when the butter was to be sent directly to market, to churn the cream the second or third day ; but when it was to be salted, to keep it a day or two longer, or till it had acquired a certain degree of acidity. The dairy-woman, who had a long and extensive experience, accounted for her conduct in this respect by observing, that butter made from fresh cream was much better and pleasanter to the taste, but that it would not take in the salt so well, or keep so long, as that made from cream that had been longer kept.

It has been observed, that those “ who have had little experience in the dairy believe that no butter can be of the finest quality, except that which has been made from cream that has not been kept above one day ; but this is a very great mistake. So far indeed is this opinion from being well founded, that it is in very few cases that even tolerably good butter can be obtained from cream that is not more than one day old. The separation of butter from cream only takes place after the cream has attained a certain degree of acidity. If it be agitated before that acidity has begun to take place, no butter can be obtained, and the agitation must be continued till the time that sourness is produced ; after which the butter begins to form. In summer, while the climature is warm, the beating may be, without very much difficulty, continued until the acidity be produced, so that butter may be got ; but in this case the process is long and tedious, and the butter is, for the most part, of a soft consistence, and tough and gluey to the touch. If this process be attempted during the cold weather in winter, butter can scarcely be in any way obtained, unless by the application of some great degree of heat, which sometimes assists in producing a very inferior kind of butter, that is white, hard, and brittle, with very little taste, and almost unfit for any culinary purpose whatever.” The judicious farmer should not attempt to imitate this practice, but allow his cream to remain in the vessel appropriated for keeping it until it has acquired that proper degree of acidity that fits it for being made into butter with great ease, and by a very moderate degree of agitation ; by which process only very fine butter can be prepared.

The length of time cream may be kept before it attains the precise degree of acidity that is necessary to form the very best butter, and after that period before its quality be sensibly diminished, has not yet been well ascertained by experiment. It is remarked by



Doctor Anderson that “so little nicety has been observed in this respect by practical farmers, even those who have a high reputation for making good butter, that few of them ever think of observing any precise rule in this respect, with regard to the different portions of their cream, seeing they in general make into butter all the cream they have collected since the former churning, so that the new and the old is all beaten up together; and he can find nothing like an uniform rule established among them as to the time that should intervene between one churning and another, that being usually determined by local or accidental circumstances. He is himself inclined to believe, that if the cream be carefully kept, and no serious matter allowed to lodge about it, a very great latitude may safely be admitted in this respect;” and though the exact length of time has not been determined, “it is certain that cream which has been kept three or four days in summer is in excellent condition for being made into butter; and he is inclined to believe, that from three days to seven may be found in general the best time for keeping cream before churning; though, if circumstances make it necessary, a considerable latitude in this respect may be allowed. If the farmer has such a quantity of cream as may be worth his while to churn once every day, there is nothing to prevent him from doing it. He has only to provide a separate vessel for holding the cream for each day he means it should stand before churning; if three days, three vessels; if four days, four vessels; and so on. Thus he may churn every day cream of three days old, or of four, or any other number of days old that he may incline. In the same manner, if it were found that the cream [of two, of three, or of a greater number of days gathering, was required to make a proper churning, it might be easy to contrive it so as to churn every day, as will be obvious to any one who thinks upon the subject. In this way the operations of a dairy may be kept perfectly regular and easy.”

It is frequently a practice in Cheshire to churn the whole of the milk without separating any part of the cream from it. After milking, it is cooled according to the heat of the weather in summer, in separate vessels for the purpose, and a certain degree of acidity brought on and warmed in the winter by being set by the fire. In this way they obtain a greater quantity of butter, though of an inferior quality. By careful management, however, especially if a portion of the first-drawn milk be separated, very good butter may, it is supposed, be obtained; but the practice, on many accounts, is not to be recommended.

In summer, or while the cows are fed on grass, no art is requisite to give butter that colour which is agreeable to the purchaser or the consumer; but in the winter and spring months the dairy people find it necessary, in order to please their customers, to alter that tallowy appearance which is natural to butter in these seasons. This is effected by means of a little *arnetta*, which, after being reduced by trituration to as fine a powder as possible, is mixed with cream before it is put into the churn, and in such quantities as, from experience, has been found necessary for giving the requisite appearance.



*Churning.*—As while the oily or butyraceous part of the milk is in the state of cream, the particles are not in a sufficiently concentrated state for producing an uniform substance, on account of the large portion of interposing serous fluid; in order to produce butter, it is therefore necessary to force out this by means of continued agitation in the process of churning. The cream or milk, after being separated and prepared as above, is to be put into the churn of the kind which is preferred, as there are several different sorts employed in different places, and agitated for some time, in order to effect the separation of the butter. “From the practice generally adopted in the best managed dairies of cooling the churn, by filling it for some time with cold water before churning in summer, and of warming it with scalding water when the weather is very cold in winter, and of putting in also cold or hot water among the cream in the churn occasionally, according to the season of the year,” it is concluded, “that cream possessing a proper temperature; whatever that temperature may be, is, among the most exact dairy farmers, considered essentially necessary in the making of good butter; which being admitted, it must follow that some churns may be better suited to the purpose than others—as such as admit a free supply of atmospheric air, and permit that which, from the violent agitation, has become overheated to escape, from their preserving that medium temperature which it would appear, cream, in the course of making into butter, ought to possess, than such as are kept constantly shut up, or, in which the air is only allowed to enter, or escape occasionally by means of a small aperture.” It is probably on this account that the upright churn is still preferred in some dairies. In this process much greater nicety is required than most persons seem to be aware of. It has been observed, “that a few hasty irregular strokes may render the whole of the butter of scarcely any value, that which but for this circumstance would have been of the finest quality. The owner of an extensive dairy should, therefore, be extremely attentive to this circumstance, and be at great pains to procure a proper person for managing this branch of the business.”

*Making of Butter.*—When, by the process of churning, or keeping the cream constantly in a state of motion, the butyraceous particles are separated from the milk, and united to each other, the mass is taken out of the churn and put into a large wooden bowl, or other convenient vessel, with some cold spring water which is perfectly pure, after which the dairy-maid kneads it well with her hands, or what is better, a wooden spoon with a short handle, afterwards breaking it into as minute divisions as possible, and by rolling and pressing it against the bottom and sides of the vessel, expresses and forces out any milk that it may contain. Upon this being well performed the goodness of the butter in a great measure depends. When it has been thus worked the milky water is poured off, and an additional quantity of pure clean water put in, and the operations of kneading, breaking, and pressing, are again renewed, and continued till the water at last appears scarcely tinged with the milk, which is the only proper criterion by which to determine when the



butter has sufficiently worked. It has been observed by the above writer, “that a considerable degree of strength as well as of dexterity is required in this manipulation. The thing wanted is to force out the milk entirely, with as little tawing of the butter as possible; for if the milk be not entirely taken away, the butter will infallibly spoil in a short time, and if it be much worked the butter will become tough and gluey, which greatly debases its quality.”

In most cases a small quantity of salt is mixed with butter which is intended for immediate use, and when butter is salted, whether it be with a view to keeping or for immediate sale, the salt is applied as soon as the milk has been extracted or removed in the manner just described. Part of the butter is spread on the bottom of another bason or *skeel*, which has been previously washed and prepared for the purpose; and a quantity of salt being strewed over it, an additional layer of butter is then laid on; over this another sprinkling of salt, and so on alternately till the whole be salted to the proper degree, according to the use for which the butter is intended. When the whole is thus salted the dairy-maid again kneads, breaks, and works it in such a manner as to make the salt mix intimately with it; and when she thinks she has fully effected this purpose, she pours some spring or other cold water over the whole: and, by again working the butter, washes it free from the brine, and from any milky substance, which by the salting, and the repetition of kneading, pressing, &c. may have been expressed.

The different operations of butter-making being thus performed, all that remains is to weigh and make it up into the form in which it is most saleable. The usual form in which it is exposed to sale is in rolls; but it is sometimes made into circular cakes of about three or four inches diameter, and about an inch thick, and on the top of which figures are impressed by means of a wooden print carved for the purpose. After the butter, in well-managed dairies, is weighed and made up for market, it is usually placed in cold water till the period for sending it to market arrives.

The quantity of butter produced from a given quantity of milk depends on a variety of particulars; as the quality of the milk, the age and quality of the pastures on which the cows are maintained, and the milk being allowed to stand a sufficient time to throw up the whole cream which it contains. But on a medium four gallons of milk will produce sixteen ounces of butter; and the quantity which a dairy of cows of any magnitude, in regard to numbers, may be supposed to yield, may be rated at six pounds each per week in summer, and from four to five in winter, according to the manner of feeding them. In Suffolk they find that four gallons and a half of milk affords a quart of cream, which, when made into butter, weighs one pound and three quarters. Mr. Abdy found the average quantity of butter made by a cow per week to be four pounds, of sixteen ounces, and the whole in nine months, one hundred and fifty-six pounds, besides the advantages of six shillings a-piece for the keep of three pigs.

An inferior sort of butter is often made from whey, where cheese is the principal object of the dairy.



*Making of Cheese.*—In the process of cheese-making, as in most of the other operations of the dairy, there is a want of precision, from few experiments having been made; and those with but little chemical exactness. As the business stands at present, the whole is conducted at random by mere custom. The circumstances that would seem to particularly demand attention in this art are, the *season*; the *method of milking*; the *nature of the milk*; the *preparation of the rennet*; the *mode of colouring*; the *breaking and gathering the curd*; the *management of the cheese in the cheese-press*; the *method of salting*; and the *management in the cheese-room*.

*Season.*—It is supposed that the best season for making cheese is during those months when the cows can be fed on the pastures; that is, from the beginning of May till towards the end of September, or, in favourable seasons, the middle of October. On many of the large dairy farms in several districts, cheese is frequently made throughout the year; but that made during the winter months is said to be considerably inferior in quality, and much longer in becoming fit for sale, or for use, than that which is made within the above period. In Gloucestershire the season of making *thin cheese* is from April to November; but the principal one for making *thick* is during the months of May, June, and the beginning of July. If made later in the summer, they are found not to acquire a sufficient degree of firmness to be marketable the ensuing spring. But where the cows are well fed in the winter season, in the manner advised above, good cheese may undoubtedly be made at that time.

*Milking.*—The times of milking are different in different cheese-districts: in Cheshire they are in the summer season at six o'clock both morning and evening; and in winter at day-light in the morning, and immediately before dark in the evening. But in Wilts, Suffolk, and some other counties, the people are frequently employed in milking by four o'clock in the morning in summer; and the business in a dairy of forty or fifty cows is nearly completed before the period at which it commences in Cheshire. The latter would seem the most preferable practice: as when the cows are brought home to the farm-yard, which is the best method where the pastures are within a short distance, they are milked unfettered, and the business is over before the heat increases so much as to make the cows restless and unruly. The farmer himself, or some careful person, should always attend the milking of the cows, for the double purpose of seeing the work properly done, and carrying the milk in large buckets, into which it has been occasionally emptied from the pails, to the dairy, to be poured through a strainer into coolers for the purpose, or the cheese-tub, preparatory to applying the rennet. In all well-managed dairies particular attention should be paid to the thorough milking of the cows; as where this is omitted the cows are not only apt to go dry, but become more liable to be diseased. Besides, it has been shown that the last part of the milk is very greatly superior in quality to that which is first drawn from the bag.

The expeditious cooling of the milk, by putting it into leaden or other pans, is found of much utility in retarding the process of fer-



mentation in the summer season, and thereby preventing the milk from turning into a state of acidity. But in winter it is obviously unnecessary. It has been suggested, that when the season is hot the quality of the cheese might be improved, and the difficulty of its being made lessened, by cooling down the milk as soon as possible by repeatedly drawing off and returning it to the cooler.

*Quality of the Milk.*—It is obvious that on the quality of the milk the goodness of the cheese, with common management, must in a great measure depend. The quantity of cream that is used is generally in practice different, according as they are *one-meal* or *two-meal* cheeses.

In Cheshire “the general custom, however, in the best dairies, is to take about a pint of cream, when two-meal cheeses are made, from the night’s milk of twenty cows. In order to make cheese of the best quality, and in the greatest abundance, it is admitted that the cream should remain in the milk; but whether the cream that is once separated from it can by any means be again so intimately united with it as not to undergo a decomposition in the after-process, admits of some doubt. There is, at least, no absurdity in attempting to prevent the separation of two bodies which it is the professed intention to unite again. If a cheese made entirely of the night’s milk on which the cream has risen be as rich as one made of new milk, all other circumstances being alike, it is a proof that milk and cream after being separated may, by heating alone, become as it were new milk again. Experiment alone can decide this point: but the practice here is to unite the milk and cream, as will be shown hereafter; and the dairymen say, that when so united it differs not from new milk as to the purposes of cheese-making.”

If the whole milking be directly made use of in its simple state for the cheese, it is denominated a *one-meal* cheese; but where two milkings are blended, or *two-meal* cheese made, the quality of the milk used differs considerably; in some cases the whole of the cream of the first meal is abstracted, and in all cases a certain portion. In some dairies the milk of the first meal is set in the leads or other vessels as usual; and as it is the evening’s milk that is in common added to the succeeding morning’s, the operation of cheese-making begins immediately after that of the morning milking is completed, as about five or six o’clock. The cream of the evening milk being skimmed off, the milk is carried and put into the cheese-tub, reserving sometimes a half, sometimes a third, but more frequently only three or four gallons to be applied as below. The milk reserved, in any of these proportions, after being put into a brass pan and made scalding hot, by placing the pan on a furnace or in a vessel of hot water, is one half of it poured into the cheese-tub among the cold milk, and the other into the pan in which the cream had been put. The cream and the hot milk being intimately incorporated, the whole is poured into the cheese-tub; which by this time has received a great addition, if not the whole of the morning’s milk warm from the cows. Thus the different meals’ milk form, as it were, a fluid of the same nature, equal in quality and temperature, and to which the rennet is applied in the usual manner. This re-union, or, in the dairy



phrase, *melting the cream*, is probably the best method practised; but it is, we believe, not so effectual in forming cheese of the best quality as that where the milk is entirely new.

In making *skim-milk-cheeses* the milk is set in the leads or pans as usual, in which state it remains longer or shorter, according to the weather, care being taken to skim off the cream, or to drain off the milk, in proper time, before it begins to acquire a sourish taste. If that should at any time happen, either from the excessive heat of the weather, or owing to some inattention in the general management; in place of putting the skim-milk upon the furnace to give it that degree of heat supposed to be necessary for facilitating the coagulation after the rennet is applied, and which is the usual practice, the method is, to put it directly into the cheese-tub, and to pour in such a quantity of hot water as will give the wished-for temperature. By this means, the risk of the milk breaking while heating on the furnace, which when not quite sweet and fresh it is apt to do, is avoided without inconvenience in other respects. In this sort of milk it is necessary to add somewhat more rennet than is usually applied to a similar quantity of milk, which contains either the whole or a great portion of the cream.

*Preparing the Rennet.*—Milk may be coagulated, or turned into a curdled state, by the application of any sort of acid; but that substance which is most commonly used in the making of cheese is the *maw* or stomach of a young calf prepared for the purpose, and which is generally denominated *rennet*. The maws, which usually contain a curdled kind of substance, on being purchased from the butcher, are opened, and the curd or thick substance taken out: this, having been repeatedly washed in cold water, as well as the bag which contained it, is again replaced with a considerable addition of salt, and then packed in a jar, into which is poured a very strong brine of salt and water. In many instances the maws are allowed to remain in this state for about twelve months before using; in others, after having remained for some time covered with the brine, they are taken out; and an additional quantity of salt being applied, they are hung up in the dairy, or some other convenient place, to dry, and remain in that state till wanted for use.

But, from the preparation in this mode being made at different times, there must be a great difference in their strength, and of course in their effects, either when made use of after being steeped in some sort of liquid, or in the piece.

Whether the proportion of rennet necessary for a season be kept in *brine* or *pickled*, and afterwards dried, the best method, as attended with the greatest degree of certainty in regard to its being of equal strength and quality, is to extract the substance from the whole at once. This is frequently the case in Cheshire, but in few other districts.

In preparing these substances it is therefore, probably, a better practice to put the whole of the maws into an open vessel, and to pour in two or three pints of spring water for each, according to the number. In this state they should be allowed to stand about twenty-four hours. They then may be taken out and put into other vessels,



with about half the quantity of water, and allowed to remain for a like period, then wholly removed and thrown aside as no longer of use, and the first and second infusions mixed together, and strained through a sieve into a jar or other vessel, a considerable quantity of salt being added. This liquor is then fit for use, and requires no after management beyond that of taking off the scum that usually rises to the top, and of adding a little salt when that already in the jar is nearly dissolved. About half a pint of this preparation, wine measure, is mostly sufficient for coagulating such a quantity of milk as will make sixty pounds of cheese. When a portion is taken out, the liquor should be well stirred up. Other modes of preparing this substance are in use, but perhaps without affording any superiority.

*Colouring.*—From the practice of colouring cheese having been so long common in the cheese districts, it is probable that those of the best quality would be in a great measure unsaleable if they did not possess the requisite colour. The degree of colour is regulated chiefly by the name under which it is intended the cheese should be sold. The introduction of this practice originated in the intention of conveying an idea of richness; but the leanest cheese always requires the greatest quantity of colour to bring it to the proper appearance. The material which is usually employed for this purpose is Spanish arnetta. The weight of a guinea and a half of it is considered in Cheshire sufficient for a cheese of sixty pounds; and in Gloucestershire an ounce is the common allowance to the hundred weight. There are different ways of preparing as well as of applying it. The method used in Cheshire is, when the dye is wanted in the morning, to tie up the necessary quantity of pounded arnetta in a linen rag, and to put it into about half a pint of warm water in the preceding evening. In the morning, immediately before applying the rennet, the infusion of arnetta is poured into the milk, and the mixture is then well stirred about, so as to make the milk and the dye incorporate intimately together. In other districts it is common to rub a piece of unpounded arnetta, after having been previously dipped in milk, on a smooth stone, in the same manner that paint is ground. The colouring thus obtained is mixed with the milk in the cheese-tub, in the manner and at the period before-mentioned, care being taken to prevent any of the un-reduced particles of arnetta from falling into it.

*Setting the Curd.*—The degree of temperature which milk ought to possess, so as to be in the best possible condition for applying the rennet, is by no means fully decided. It is, however, admitted that the quantity and quality, or texture of the curd, depend much on the length of time the curd is in forming, and that on the quantity and strength of the coagulum employed, the state of the atmosphere, and the heat of the milk, at the period of its being mixed. In this matter the practice of almost every particular dairy differs from that of another. That which is adopted in Cheshire is, that the lowest degree of heat which milk ought to possess when the rennet is applied, is one half of that of the milk from the cow; the highest about twice the natural warmth. From this it is inferred, “that by the time a large dairy of cows can be milked, and the



milk be put together for the purpose of artificial coagulation, the dairy-maid will not err materially by applying the rennet immediately afterwards." This rule is however very uncertain, and liable to exception, on account of the variation in the seasons, and the frequent and great changes that take place in the state of the weather in the same season. Accordingly, "in all dairies remarkable for cheese of a superior quality, the heat of the milk, before the rennet is applied, is raised or lowered by the addition of warm milk, or of cold water, to that degree which, in the practice of the particular dairy, is found from experience the most eligible." The milk produced on poor clayey lands is found to require more warming than that afforded by such as are rich, for where this is much heated the process is rendered more difficult. The frothy matter, arising in consequence of the air that is entangled with the new milk in pouring it into the cheese-tub, is in all cases carefully skimmed off, and put into the cream-vessels.

It is thought "surprising that in large dairies the use of the thermometer is not as well known as that of the *skimming-dish*—as to ascertain with precision, by a course of well-conducted experiments, the temperature the most proper for milk to possess at the time the rennet is applied, could not fail to be greatly in favour of the quality of the cheese, and would, in all probability, tend to prevent the cracking, blistering, and hoving, which so frequently take place in cheese in consequence of some mismanagement in the making.

An instrument has been lately invented, which, if found on experience to answer, must have the effect of throwing a great deal of light on the whole system of dairy-husbandry, and must be the means, in time, of reducing the business of butter and cheese-making, which is at present carried on without any established rules by which the operator can be certainly guided, to something like fixed invariable principles. It is termed a lactometer. By the use of this instrument, together with the thermometer, and by discovering a mean whereby to ascertain the strength and quality of the rennet, and the proportion which is necessary to be used for coagulating a given quantity of milk, Mr. Donaldson supposes the management of a dairy where cheese is made would be greatly improved. Practice is the only mean by which the operator can acquire a proper knowledge of this branch of the business; but the consequences of proper or improper conduct are well known in every cheese-dairy; as, when the coagulation is accelerated or retarded beyond the proper time, which in making a 60lb.-cheese is reckoned an hour and a half, either by giving too much or too little rennet, or by applying it when the milk is too hot or too cold, not only the quantity of curd is diminished, but the quality in either case materially affected. In the former case it becomes of a tough gluey texture; in the latter it is too tender. After the rennet has been applied the milk-tub is covered up by a board, over which is laid a linen cloth; and having stood the usual time, the operator, on finding that the coagulation is completed, proceeds with the work of separating the curd from the whey.



*Breaking and gathering the Curd.*—Though this business may appear simple and uniform, there are few particulars in the art of cheese-making wherein so great a difference is observable in practice. In some dairies the curd is at first broken or cut in various directions with a cheese-knife, an instrument made for the purpose, and used with a view of making the whey separate easily, and without carrying off with it any richness from the curd. After these first incisions some time is allowed for the broken curd to subside. The knife is then again used, and more freely than before; and while the operator stirs up the unbroken curd from the bottom with the skimming-dish in one hand, the larger pieces of curd are cut with the knife held in the other. Having thoroughly broken the curd, and allowed some time for its subsiding, the operator begins to take off the whey with the skimming-dish. In other dairies, not less celebrated for good cheese, the skimming-dish only is used in breaking the curd; and to facilitate the operation of separating the whey from the curd, some of the whey that first rises to the top is skimmed off, and being heated or cooled, according to the state of the weather, and the required consistence of the curd, is again returned into the cheese-tub, and after returning a little time the whole is laded off in the usual manner. All the whey that can be extracted without pressure having been removed, and the cheese-tub being raised at one side, the curd is collected into a mass, and at first pressed with the back of the skimming-dish. When no more whey can be discharged by this means, others more violent are adopted: the curd is in many cases cut with the cheese-knife, as before, to give vent to the whey, and is then pressed as hard as possible with the hands; in others, a considerable weight is frequently applied. The curd having in a great measure separated from the whey, it is put into two or three pans, or other vessels, and the cheese-makers break it with their hands as fine as possible; in the course of doing which, a proper quantity of salt is scattered over the curd, and intimately mixed therewith.

In Gloucestershire, when the curd is broken to the requisite fineness, it is again returned into the cheese-tub, where it is scalded, by pouring over the minutely broken curd a pailful of hot water, or of whey, or of whey and water mixed. After the scalding water or whey is applied, the whole is briskly stirred; and being allowed to stand for some time, for the curd to settle at the bottom of the tub, the scalding materials are skimmed or poured off; and the curd being pressed as before, so that no more whey can be extracted, it is put into the vat, and pressed in the common way. When it is properly broken, rubbed, and salted, a cloth is spread over the cheese-vat; and the broken curd being packed into it, and covered up with the cloth, a board is laid over the vat, and a weight, heavy in proportion to the quantity of curd, placed upon it; by which means the remaining whey is pressed out.

Mr. Marshall observes, that “it seems to be understood, that different grounds require different kinds of scalding liquor. The quantity is in proportion to the quantity of curd, enough to float the curd,—and make the mixture easy to be stirred about with the



dish. Part of it is heated to near boiling heat, and this lowered with cold liquid to a heat proportioned to the state of the curd: soft curd is scalded hot, hard curd with cooler liquid. In scalding, therefore, the dairy-woman has a remedy for any misjudgment her sense of feeling may have led her into in the stage of coagulation: let the curd come too soft or too hard, she can bring it to the desired texture by the heat of the scalding liquid. And here seems to hinge, principally, the superior skill of the Gloucestershire dairy-woman: by running the milk cool, she can, in scalding, correct any error which has been committed in the former operation."

Extensive dairies should always be plentifully furnished with vats of different sizes, as, when three or four cheeses are made at each meal, a number of vats become actually in use; and if there are not still a number empty, the operator becomes confined in choice, and cannot proportion exactly the vats to the quantity of curd in the cheese-tub; and by keeping a little overplus curd from meal to meal a whole cheese is often spoiled.

Having made choice of a vat or vats, proportioned to the quantity of curd, so that the cheese when fully pressed, shall neither over nor under-fill, the operator spreads a cheese-cloth loosely over the vat, into which he re-breaks the curd, carefully squeezing every part of it in the hand; and having filled the vat heaped up, and rounded above its top, folds over the cloth, and places it in the press.

Where the cheeses usually made are of a large size, as in Cheshire, the operator thrusts a number of iron skewers, through holes made in the sides of the vat for the purpose, into the curd in various directions. These being withdrawn, the openings made by them serve as so many drains for permitting the whey to run off. When the whey, instead of running freely, only falls in drops, the weight is removed, and the curd rebroken, and, being again put into the vat, is managed in the same manner as before, and repeated while a drop of whey can be extracted. The curd being now almost entirely freed from the whey, it is again placed in the vat, a clean cloth having been previously spread for the purpose of receiving and inclosing it.

*Management in the Press.*—After the vat has been properly placed in the press, a suitable degree of pressure is applied, which is more or less according to the sizes of the cheeses. In all large dairies there are two or three presses, all varying in respect to power, weight, or pressure. As soon as the vat is placed in the press, and the weight applied, skewers are again thrust in through the holes in the sides of the vat; this is done repeatedly during the first day the vat is in the press. From the time the vat is first placed in the press till it is again taken out does not in common exceed two or three hours. When taken out, the cheese is put into a vessel with warm or hot whey, in order to hardening its coat or skin, where it stands for an hour or two; it is then taken out, wiped dry, and after having remained some time to cool, is covered with a clean dry cloth, and the vat being wiped dry, and the cheese replaced, it is again put into the press. In the evening, supposing the cheese



to have been made in the morning, which is the common time, it is again taken out of the vat, and another dry cloth being applied, is returned and replaced, what was formerly the upper becoming now the under side. In this manner it is taken out, wrapped in clean cloths, and turned in the vat twice a day for two days, when it is finally removed. Cloths of finer qualities are made use of at the different turnings, in order that as little of their impression as possible may be left on the cheese.

*Salting.*—After the cheese has been at last removed from the press, it is carried to the salting-house, and placed in the vat in a tub filled to a considerable depth with brine, in which it stands for several days, being regularly turned once at least every day. The vat is then removed from the brine-tub; and the cheese being taken out is placed on the salting-bench, where it stands for eight or ten days, salt being carefully rubbed over the whole every day during that period. When the cheese is of a large size, it is commonly surrounded with a wooden hoop, or fillet of cloth, to prevent rent-ing. After it is supposed to be sufficiently salted, it is washed in warm water or whey, and, when well dried with a cloth, is placed on what is called the drying-bench, where it remains an equal length of time before it is removed to the keeping-house or cheese-chamber. In some dairies, the new cheeses are not put in brine, but kept in the vats on the salting-benches; and after being rubbed with salt, and turned in the vats daily for a week or ten days, the vats are removed, and the cheeses managed as above. In other dairies the cheeses are salted while the operation of pressing is performing. At every time they are taken out of the press for the purpose of being turned in the vats, they are well rubbed with salt, which for small thin cheeses, such as are commonly made in Wiltshire and Gloucestershire, is found to be sufficient; and therefore, when taken for the last time from the press, in place of any more salt being applied, they are set at once upon the drying-benches. In fact, the practice of immersing new-made cheeses in brine is only adopted where they are of so large a size that rubbing salt on the outside would not be sufficient for answering the intended purpose.

*Management in the Cheese-room.*—After the cheeses have been properly salted, and have acquired a competent degree of dryness, they are carried from the salting-house to the cheese-room, where, after being smeared with fresh butter, they are laid on the floor, or on shelves for the purpose. For the first ten days or a fortnight they are pretty smartly rubbed every day, and the smearing with butter repeated; but after that period it is only necessary to rub them two or three times a week; yet they should be turned every day while in the dairy-man's possession, which is longer or shorter according to the season of the year, and the demand. In order to hasten the maturation and coating of the cheese, the temperature of the room should be uniform and rather warm. In some cases the floors are prepared by being rubbed over with different green vegetable substances, such as bean-tops, &c. and in others covered with dry substances; but these are probably unnecessary.



The produce of a dairy of cows, where the milk is converted into cheese, is variously stated by different farmers. In some districts two hundred weight and a half from each cow, whether a good or bad milker, if at all in milk, is considered a good annual return. In others, the average runs as high as three; and in the county of Wilts in particular, from three and a half to four is the usual quantity. From accurate calculations made by Mr. Marshall, and these several times repeated, he found that in Gloucestershire about fifteen gallons of milk were requisite for making little more than eleven pounds of two-meal cheese, and that one gallon of new milk produced a pound of curd. It is the general opinion of dairy-farmers, that the produce of from two and a half to three and a half acres of land is necessary to maintain a cow all the year round. "Taking, therefore, the medium of the three averages of cheese above-mentioned (amounting to 355lb. from each cow), the quantity of cheese by the acre is 118lb." Every calculation of this kind must, however, be extremely vague and uncertain. The correctness of this is, however, to a considerable degree, confirmed by Sir William Petty's statement in his *Political Economy of Ireland*, in regard to the quantity of milk which he supposed the cows in that country to yield in the year, viz. "for ninety days three gallons, for other ninety days one gallon; for the next ninety days a quarter of a gallon, and for the remainder of the year none, making in all three hundred and eighty-four gallons; which, considering that in every dairy, a certain quantity of cream is abstracted before the milk is put into the cheese-tub, it may be supposed, when converted into one-meal or two-meal cheeses, to make a little more or less than 355lb. as has been just stated."

It is obvious that, in both the butter and cheese-dairy, a great part of the profit must necessarily arise from the keeping and fattening of hogs. In this intention the skim-milk, butter-milk, and cheese-whey, should be converted to the purpose for which they are the most adapted, which would seem to be that of supporting sows that have pigs, and rearing young pigs. It has been observed that "in these applications they are better than any other article of food within the farmer's command, that is to be had equally cheap; and by means of keeping a number of breeding sows, proportioned to the use of the milk and whey of the dairy, and making a proper provision for the other sort of hogs, so that they need not rob this application, the most profit possible will be made of these important objects to the farmer, by his cows and swine." In this system of management it is of vast advantage to have the hog-sties convenient to the dairy, with suitable sunk cisterns, properly formed for the reception and retention of the milk, whey, &c., which should be conveyed to them by pipes from the lip of the cheese-press, and a receiver on the outside of the dairy or scalding-room, so that every thing may be taken away without the labour of being carried, and nothing be wasted. Mr. Abdy, in speaking of the butter-dairies of Epping, remarks, that the farmers there buy pigs at four or five months old, (which in the year 1788 cost about 18s. a-piece,) and keep them on skimmed milk for the space of a month, and then sell



them at the profit of about 6s. The proportion in which they are kept is that of one to every three cows in milk; which, as their long-horned Derbyshire breed of cows mostly continue to milk for nine months, will be in the ratio of three pigs to each cow, or eighteen shillings, but at the present prices more than thirty shillings.

## SECTION XXI.

### *Cultivation of Grass Land.—Methods of fattening Animals.*

**T**HIS is a sort of management which is constantly more or less connected with grass land, but which differs very considerably in the different practices which are pursued in bringing the animals to the proper states of fatness for which they are designed.

*Grazing.*—There are particular situations and kinds of grass land on which this system of management may be had recourse to with much more profit and success than that of dairying. This is mostly the case in all those districts where the extent of arable land is inconsiderable when compared with that which is in the state of pasture, and of course the value of grass-produce but small in comparison to that of fattened animals. In all the tracts of grass land that are sufficiently fine and rich enough in quality to fatten oxen or other large cattle, this practice may be adopted and carried on with profit and advantage, and is probably the best application of such lands that can be attempted. This indeed is fully shown by most of the rich, fine, marshy, or other tracts of grass land in different parts of the kingdom being almost invariably conducted under some branch of the grazing system.

The success of this practice, like those of most others employed in the art of husbandry, will depend on different circumstances; as the situation and quality of the land, the accuracy of the management in regard to the method of stocking and feeding it; the nicety of the farmer's judgment in adapting the animals in nature, size, and quality, to its particular condition; and, above all, to his discernment in selecting such stock, of whatever kind it may be, as is perfectly healthy and disposed to fatten, as well as in obtaining it at such price as that it may pay well for the keep bestowed upon it; and in ultimately disposing of it, when brought into proper condition, to the best advantage.

The stocking of grazing lands with a proper kind of animals is probably one of the most nice and difficult points in the whole range of farming. In the natural state, such animals are in general produced on the lands as are suited to the state and nature of their herbage; thus, in the mountainous districts, where the grass is short and light, the small breeds of both cattle and sheep prevail; while in the low, rich, marshy, or other pastures, where the grass



is more full and luxuriant, we have the larger breeds of these different animals. It will therefore be necessary, in this business, for the farmer to consider two things: first, what sort of stock may be the most proper for the particular kind of land on which they are to be grazed; and, in the second place, what sorts may afford the greatest profit in the consumption of the herbage. It will probably in most cases be found, that upon the strong and more dry rich pastures the larger sorts of cattle and sheep will be the most proper, and turn out to the greatest advantage; but that on such as are less dry and luxuriant the different smaller breeds of cattle, as well as sheep, may be found to pay the best. This is in some degree proved by the practice of the graziers in different districts. On the rich lands in Sussex and Lincolnshire, as well as other grazing counties, they prefer the large breeds of cattle as well as sheep for the purpose; while in many others that are less fertile the smaller sorts are found more to the advantage of the grazing farmer. In pastures where the grass is short, sheep are mostly the proper sort of stock.

But besides this circumstance of adapting the stock to the nature and situation of the land, the properties of the breeds must be attended to. Those sorts, whether cattle or sheep, which have the property of keeping themselves fat, or in tolerable condition, with the least expenditure of food, should be constantly preferred, whatever the size or breed may be. It is a quality that has been observed to be of much greater importance to the grazier than that of size, abstractedly considered.

It has been well observed, that where the grazier has fine and rich pastures, he may "choose his beasts as large as he can find them, provided they are of the right breed and shape; but let him always prefer shape to size; for it will assuredly pay him better." And it is added that "those who are upon indifferent grass must take care to proportion the size of their beasts to the goodness of their pastures; their cattle had much better be too small than too large; there are vast tracts of land that will answer well in grazing, which are not good enough to support large breeds."

The same thing, probably, holds good in a great measure with respect to sheep.

Where the stock is bred upon the land, there will be little difficulty in fixing upon such animals as are the most suitable in these different intentions; but as it will frequently be necessary for the farmer to purchase his stock at fairs and other places, much care and attention, as well as knowledge, will be requisite for him to do it in the most advantageous manner. It is of great importance in this business to provide such as have been kept in a proper manner, and are in a healthy, thriving condition, as, where the contrary is the case, they are difficult, and require a much greater length of time, to be brought into the state proper for sale than would otherwise have been necessary. It is perhaps experience alone that can qualify the grazier to form a correct judgment in these respects: in general, however, he is led to the choice of stock by no fixed or scientific principles, but by the impression the appearance of the animals have upon him. It has been observed that the experienced



grazier, who has been accustomed to attend fairs and markets, knows at sight, or by the assistance of the slightest touch, whether the animals he is about to purchase will suit him. Their general form and looks please him. They are every where clean; have little offal about them; their eyes are full and vivid; their countenances brisk; their skins alive, and their flesh mellow. On the whole, they have the resemblance of those which have been grazed before with success. Others are rejected, from the grazier not having found any such as they resemble to have done well, but many to have turned out in an unprofitable manner.

There are, however, principles in this branch of the farmer's business which may be attended to with great advantage, as the animals have certain points or parts, the proper or improper forms of which denote them to be valuable or the contrary for this purpose. These are, that the legs should be short in proportion to the size of the animal; the back very straight, broad and flat; the loins wide; the carcase deep, round, or rather barrel-shaped below: the fore-quarters round, full, and spreading; the bones small; the flesh affording an elastic feel; the skin thin, and a disposition to fatten well, and on the best parts. Where these marks are predominant the stock is mostly suitable for the purpose of the grazier.

It has likewise been remarked, that where the hair of the hide in fattening cattle is inclined to curl instead of being straight, they are most disposed to thrive. This has been found to be the case in practice in different parts of the kingdom. In lean beasts also, when the hair of the hides is curled, they commonly keep themselves in better condition than where the contrary is the case. In all cases a disposition in the animals, of whatever sort they may be, to wildness, and not remaining quietly in the pastures, forms an insurmountable objection in this system of management; as no animal ever fattens well that has a tendency to ramble: it is quietness, feeding quickly, and lying much, that has the great tendency to make them become fat in a short time. From the result of actual experiment with four different beasts, in which the least possible difference could not be discovered on the most minute examination, it has been shown that too much attention cannot be bestowed in the choice of the breeds of fattening stock, as, though they were in every respect the same in appearance, two, from their superior disposition to fatten, were found to afford a profit in the proportion of fifteen shillings the week, while the other two did not yield more than about five shillings and ten-pence.

In different situations different sorts of both cattle and sheep must often be preferred from the ease and convenience of procuring them; but the graziers in the midland districts for the most part find that variety of the long-horned, termed the Craven breed, to answer the best, as having the most advantageous form, and the greatest disposition to fatten readily, especially as improved by Mr. Bakewell. In Lincolnshire some prefer the large short-horned breed, others long-horned, with a mixture of other kinds; as the different sorts of Scotch, and such as are bred in the neighbourhood. In Somersetshire the dark-red Devonshire breed is the most prevailing sort,



which have also of late been more in demand by the best graziers in Leicestershire, Oxfordshire, and Warwickshire. In the London markets these are said to come next to the Galloway Scots that are fattened by the Norfolk and Suffolk graziers, in the fineness of the grain of their flesh and their internal fatness. The Cumberland and other North-Country graziers mostly employ the home breeds, which are in general of the long-horned kind, with both the Scotch breeds, the Kiloe and Galloways. They find the Kiloes the quickest feeders, the Galloways the next, and their own the slowest.

The Herefordshire, Glamorganshire, and Suffolk Polled breeds are all found valuable as grazing stock in different situations.

The breeds of the particular neighbourhood, as well as cattle of the small Welsh or Scotch kind, may often be the most profitable where the grass lands are not of a rich or fertile nature, as the size of these may be more easily proportioned to the quality or goodness of the lands; and there are scarcely any so indifferent as not to be capable of bringing the smallest to a sufficient state of fatness for the market.

In regard to the descriptions of this sort of stock that may be employed with the great profit by the grazing farmer, they are unquestionably oxen and spayed heifers, the latter in general fattening not only much better, but more expeditiously, but are not capable of being procured with such facility; and of the former kind, such as have been accustomed to work are preferred in almost every grazing district, as both fattening more kindly, and making better beef than others that have not been employed in that way. When killed at a great age, after being kept to work, the beef has been found extremely good. In some cases cows that have become dry, as well as such old cows as are found unfit for other uses, are purchased by the grazier for the purpose of fattening: but the danger of success in these instances is always considerably greater: of course, though they occasionally turn out to much advantage, such as have been mentioned above are constantly to be preferred. Cows, especially those that are of much age, scarcely ever fatten well, and never in a quick manner: they can therefore hardly ever be equally profitable for the uses of the graziers as those of other sort of young stock. Whenever cows are employed for the purpose of grazing, they should constantly be let take the bull either before they are turned into the pastures, or as soon after as possible, and be always in a state fit for the market at least three months before the period of their calving.

In this business, rather young or middle-aged cattle stock are perhaps always to be as much preferred as possible, from their having in general a greater propensity to thrive and become fat. And it is of material consequence, as has been just mentioned, that they are in a good thriving condition when bought in; as when this is the case they become fat with less food, and in a much shorter space of time.

In regard to sheep stock, it is probable that in general the large improved long-woolled breeds may be the most profitable on the



more rich and productive pastures; but on those where there is a less degree of fertility, and the grass is shorter, the more small short-woolled improved breeds are preferable for the uses of the grazier. In the first of these cases, that sort which is termed the New Leicester has of late years had numerous advocates, and is, perhaps, when all its properties are considered, to be in *general* preferred to any of the other long-woolled breeds: though, in particular instances of very rich grazing lands, in the view of wool, there are other sorts that may probably be more advantageous. Where wethers are capable of being procured of the New Leicester kind, they mostly turn out an excellent stock for the grazing farmer. In the latter instance the South Downs are in common the most advantageous sort, as not being exceeded, perhaps, by any of the short or middling-woolled breeds. There are many other breeds of both the long and the short-woolled kinds that may be employed with equal if not greater advantage in particular situations, and under particular circumstances.

In Somersetshire the Polled sheep of the lower part of that district have lately gained ground over those of the Dorsetshire sheep, formerly the prevailing sort by the best grazing farmers. They afford a large shear of wool, fatten quickly, and particularly on the internal parts. They are supposed capable of improvement by crossing with the new Leicester breed. The Romney Marsh graziers principally employ the white-faced Polled and the South Down breeds, both of which they find profitable on their lands. The Cumberland graziers chiefly stock with the true black-faced Heath and Cheviot breeds of sheep, the former of which they find the more quick feeders, as well as more hardy.

It has been observed to be an advantage in the grazing of sheep, to procure them from situations where the lands are less rich than those on which they are to be fattened, as under such circumstances they are found to thrive in a more rapid manner, and, from their bearing the pen or fold with less injury, become fat in a shorter space of time.

In the system of grazing management, many different methods of practice are employed, both in respect to neat cattle and sheep. With some graziers it is a method to purchase their cattle in the fairs in the autumnal season, about October, or in the following month, supporting them, during the winter, principally with straw, or sometimes, which is a much better practice, with a little hay mixed with it, till towards the beginning of March, continuing their fattening through that and the succeeding month with some sort of succulent food, such as turnips, potatoes, or other similar kinds, until the grass be in a state fit to be turned upon in May, on which they may be carried forward and completed according to circumstances about August, or in the following month.

Another method of management is to purchase the beasts lean, as soon as the grass lands are in a state fit to be turned upon in May, wholly completing their fattening on the grass about the latter end of October, or later in the autumn, according to their quickness in



feeding. In this system of practice the smaller sorts of cattle stock may be found in general the most advantageous, especially where the lands are not of the most fertile or luxuriant kind.

The grazier has also sometimes recourse to another mode of proceeding in his system of fattening neat cattle; but which is, we believe, in general less profitable than either of the preceding methods: this is that of buying in his stock at such periods, according to the difference in their sizes, as that they may be ready to be disposed of about April, or in the succeeding month, a period at which they usually fetch a high price. In this system, with large oxen or other sorts of beasts, it is sometimes the practice to keep them through two winters, giving them only one summer's grass; being in the first winter not fully fed, but kept in good grass in the summer season, and forced on with the best feeding in the second; but with the smaller sorts of stock, one summer's grass and a winter's stalling is the usual mode; the cattle being bought in as soon in the spring as the grass is risen to a good bite.

In some districts heifers are preferred to oxen, in which case they buy them in about March or April, and, after keeping them through the summer, sell in October and November. This method is thought by some a profitable system of management. All those methods may probably be practised with advantage under different circumstances; but it is obvious that the first can only be had recourse to with propriety where green winter food is raised in sufficient abundance, and the grazier has a store of litter for being converted into manure. Under other circumstances the second mode of management will be much more profitable. The two last methods are the least convenient, and, probably, on the whole, except in very favourable circumstances, the least profitable, especially the former of them, as, from the great length of time which they are kept, much management and attention to food becomes necessary to render them advantageous; which, with common servants, is seldom sufficiently regarded.

Besides these, there is another practice that deserves attention in particular cases, such as that of buying in small cattle in tolerable condition in the autumn, as soon as the after-grass is ready, in order to their being fattened out on the rouens, and disposed of towards the latter end of October, or beginning of the following month. This is a practice sometimes beneficially pursued on the rich hay-farms in the county of Middlesex.

With sheep stock different systems of grazing are likewise in use. In some cases, where the lands are in a state of inclosure, it is a profitable practice to buy ewes in lamb in the latter end of summer or beginning of autumn, keeping them on the inferior sorts of grass-lands, stubbles, or fallows, till the beginning of January, and then by giving them turnips or cabbages to keep them in good condition through the period of their lambing, and afterwards in the best manner that can be contrived, in order that the lambs may become fit for the butcher sufficiently early to admit of the ewes being afterwards fattened, and disposed of in the beginning of the autumn.

Another method of grazing sheep is to purchase wether stock



about the beginning of May, at the age of two or three years, keeping them scantily till some weeks after the grounds have been cleared from hay, then bringing them to good keep in the rouen, afterwards fattening them by means of turnips or cabbages, so as not to have them ready sooner than the beginning of March, which is usually the season in which they fetch the best price. This is a species of grazing-management that mostly affords a good profit to such farmers as are sufficiently attentive to it.

In addition to these methods there is another, practised in some cases with great profit and advantage, which is that of buying in lambs of the wether or other kinds about the beginning of September. These are kept in different methods by different managers: by some they are brought forward with the greatest possible expedition by the best keep, so as to be ready to be disposed of as soon as possible. Others, however, adopt the contrary method, keeping them only in a middling way during the winter, till about the beginning of April, and then forcing them by good keep, so as to have them ready for the butcher in August, or continuing them in the following month, and then clearing the whole of the stock from the land. This is a practice from which great profit is often derived.

The providing of grass-lamb for the markets as early as possible in the spring months is an object of great importance, and which pays the grazier well in many situations, especially near large towns. In this view it is the practice to procure the more forward ewes, such as those of the Dorset kind, which may drop their lambs in the beginning of January, if not before. In Middlesex, where this management is much attended to in consequence of the great demand, it is the custom to purchase this sort of ewes at Kingston, Weyhill, and other fairs in the neighbourhood. The ewes, in order that they may have a plentiful supply of milk, are extremely well kept on turnips, and fine green sweet rouen hay, and the lambs thereby forced forward in such a rapid manner as to be ready for the markets in the beginning of March or April. The ewes, from their becoming dry so early, are capable of being fattened and disposed of towards Michaelmas, usually fetching the prices at which they were purchased in at: as the whole of the stock is in this system cleared within the year, the farmer has the opportunity of fully ascertaining its advantage or disadvantage. In this management very much depends upon keeping the ewes perfectly well fed, and in dry, warm, inclosed pastures, as without such attention the ewes are apt to become thin and lean in consequence of the greatness of the evacuation, and afterwards to require a much longer time in being made fat.

In the fattening of grass-lambs Mr. Marshall, in his Midland Counties, has mentioned a practice which in particular cases may be advisable; this is that of removing the lambs from the ewes when they decline much in milk, before they are perfectly fattened, in order to complete them on young clover, or other sorts of "prime keep." The principle in this case is that of the ewes becoming sooner ready for the butcher: besides, it is supposed by some, that after the first flush of milk is gone and it begins to be scanty, the



lambs thrive better “on grass alone, away from the ewes,” than when kept along with them, as the hankering after the little milk that is afforded prevents their feeding freely on the grass. Where this method is followed, which can probably be with advantage only where the milk of the ewes is *greatly* deficient in supporting and bringing the lambs forward, much attention must be paid to having the keep early and in abundance. In this view rye-grass and white clover for early use, and broad clover at a later period, may be the most proper and useful crops. In this management the ewes should be carefully examined occasionally; and where much deficiency in the milk is found, the lambs be immediately removed to the pastures.

The proportion in which different sorts of cattle and sheep stock should be introduced upon the grass lands with the view of being fattened, must depend chiefly upon the goodness of the land, the size of the stock, and various other circumstances that have been already noticed. In Lincolnshire it is on the average with sheep something more than three in summer and two in winter per acre, with one bullock in the former season to two and an half acres. In Somersetshire, when at grass on the rich and middling sorts of land, they allow from one acre to an acre and a half to an ox, and some add one sheep to each ox.

The great principle is never to stock in such a way as to restrict the animals in the least degree; as it is by filling themselves quickly, and lying down much, that the greatest progress in fattening is made, whether in cattle, sheep, or any other sort of animals when at grass. On the weaker grass lands a much smaller proportion of stock than on those of the rich and fertile kind can only be admitted. Often not more than an ox and a sheep or two, to two acres or two acres and a half. There is also another circumstance that is necessary to be attended to in bringing the stock properly forward in the pastures, which is that of changing them more frequently than has generally been the case with graziers. On this principle, as well as those of their affording greater degrees of warmth and shelter, and thereby promoting the growth of the herbage more abundantly, small inclosures may be more advantageous in the grazing of live stock than large ones; but to have them varying the size from ten or fifteen to twenty-five acres or more, according to the nature of the pastures, may be the perfection of the system: the matter is not, however, easily decided by experiment, as no two pieces of grass land can scarcely be met with that are precisely equal in all their different circumstances.

In the disposal of the stock after it has been made fit for the butcher, considerable care is necessary to perform it in the most advantageous manner. It has been observed, that though this is a less difficult part of the business of the grazier than that of buying in, it demands much judgment and experience to manage it in the best way. Some utility in directing this matter may be derived from a careful attention to the manner of fattening the animals during the time they are at full grass, and from the consideration of the length of time they have been; but the most correct judgment may probably be formed by the occasional use of the weighing-machine, by



making accurate comparisons of the living with the dead, or profitable weights of different sorts of animals that are sold on the farm, as by this means. after a few trials, a facility in correctly deciding on the dead weights of such parts of the stock as the living weights have been fully ascertained in may be attained. It is in this way that the butcher has a superiority over the grazier. All the smaller sorts of animals, such as calves, sheep, and hogs, may have their living weights ascertained with great ease and convenience by the simple mean of a pair of large *steelyards* being fixed up in any convenient place, and a sort of contrivance for containing them, with doors at the different ends, usually termed a *cage*. The frequent weighing of all sorts of fattening animals may also be beneficial in other ways: it will show with exactness the progress that is made in the feeding of any sort of animals, and the proper periods of disposing of them, as well as any changes that may be necessary in their pasture or other food, and at the same time ascertain the pay of each. In this business it is mostly, however, the case for the grazier to decide by the eye, and the feel of the animal, but this mode is extremely fallacious, even with those who have had a large experience.

In the mode of disposing of his fat stock the grazing farmer must be directed by the nature of his farm and the circumstances of his situation. In the southern parts of the island, Smithfield is the principal market; but in the northern parts of the kingdom the several large towns. In the first case, on the smaller sorts of farms, the fattened stock is mostly sent up by men who are solely employed in the business, and who are termed district drovers, being regularly employed by different graziers in the same neighbourhood, and in whom they have the most perfect confidence. But where the farms are very extensive, so as to enable the graziers themselves to regularly send droves of cattle or other stock to this market, the common practice is to depend upon salesmen for the disposal of them.

On very small farms, where the lots are not sufficiently large to make it an object to have them brought up in these ways, it may be more profitable to dispose of them to the butchers at home. The advantage of these different markets must depend much upon the particular circumstances of the case. It has, however, been suggested, that amongst the Somersetshire graziers it is a prevailing opinion that the London market, from the great fluctuation in the prices on account of the differences in the supply, is only calculated for those who pay a regular weekly attendance. The difference in the expenses, including the salesmen's commissions, are very considerable, as amounting in London to twelve shillings per head, while in the country markets they are not more than from three to five shillings.

It is evident, from what has been advanced, that the advantage of grazing must be influenced by a variety of circumstances, and be very different in different instances and situations: but that in all cases it must very materially depend on the goodness of the system, and the excellence or superiority of management that is practised. It has been observed, in speaking of Romney Marsh grazing, which is chiefly sheep, that no regular method can be adopted in that sort



of management, and that the profits of no two graziers are perfectly "alike on the same given quantity of land," nor could they be "upon the same land," as years, prices, and abilities differ with each individual. It is consequently impossible to give any statements that can be generally applicable.

But in other districts, as Lincolnshire, the profits of this practice appear to much greater advantage.

In some cases the young horses may be grazed upon the coarser sorts of pastures with advantage; but in general, except under the breeding system, it will be more profitable to keep them on green food, cut fresh as it is wanted, during the summer season: the benefit in the way of manure is very great in this method. In Somersetshire, where any horses are admitted on the grazing grounds, it is very sparingly, not more than in the proportion of one to twenty acres.

It has long been a practice to turn hogs upon pieces of grass land adjoining the farm-yards during the summer season, but this has mostly been done without any distinction of their kinds or ages. But the improved practice is to separate those that are advanced in their growth to one half or more from the sows and young pigs, turning and confining them about the latter end of May on the clover, chicory, or other similar crops, without suffering them to return to the yards to be fed with other sorts of food, water being provided for them in the fields. They are let remain on these pastures till the beginning of the autumn, when they are found to return in excellent condition for being put to fatten. Herbage of these kinds is found not only to agree perfectly with them, but to promote their growth in a remarkable manner. But, much as this system of management has by some been extolled, there seems to be one principal defect in it, which is that of the loss of the manure, a circumstance of great importance to the farmer. The practice would, therefore, probably be improved by having the yards connected with the pastures, and well littered down, or, where on an extensive scale, cheap temporary yards made for the purpose and kept in litter for them to retire to and evacuate themselves in during the night by being shut up in them. In this way vast stores of manure would be produced, which must otherwise be in a great measure lost, and at the same time the thriving of the hogs be promoted by their being kept more warm and sheltered in the night. By this management the farmer has great advantage, in being left at full liberty to convert the whole of his other sorts of food to the support of the young and breeding stocks. But profitable as this practice may be, it would seem to be less so than that of soiling them in properly prepared yards, especially where they are left in the fields without being confined during the night.

*Soiling and Stall-feeding.*—Besides the above, there are other systems of feeding and fattening animals that seem properly to come under consideration in this place, such as those of *soiling* during the summer season with various kinds of luxuriant green vegetable crops, and *stall-feeding* in the winter months with roots, cabbages, turnips, and other sorts of food of a succulent nature, in com-



bination with various kinds of dry meat. The former of these modes appears to have had much less attention bestowed upon it than its utility and importance demand. Without attending sufficiently to the economy and advantage of the practice, it has been the common husbandry in almost every part of the island to allow all sorts of neat cattle to be grazed in the pastures. In some cases of improved farming it has indeed been lately pursued in some degree in the stable, but without being applied to the cattle stock. The principal circumstances that recommend this system of practice, are those of the food being consumed with much less waste, and of course going vastly further than when fed upon the land: the great increase of good manure that is produced, and probably that of the stock feeding with less interruption and inconvenience, in consequence of their being more effectually shaded from the heat of the sun and better protected from the harassing attack of flies. In all these points, this method would indeed seem to have a vast superiority over that of letting the animals range over the pastures. It has, however, been objected against this scheme of feeding, that the expense of conducting the business is too considerable. The experiments of Mr. Mure, which were conducted upon a very extensive scale, as well as those of Mr. Young, shew that this with the care of the cattle may be performed at an expense in proportion to each, that can never afford any solid argument against the practice. It has likewise been sometimes contended, in opposition to this management, that such part of the stock as are in milk do not afford it so abundantly as when fed in the pastures. This is, however, probably a mere supposition, unsupported by facts, at least we have not met with any well-conducted experiment that has proved its truth, and it is obviously at variance with the experience we have of the effects of such sorts of green food, in other cases; for it has been, we believe, almost invariably found, that most of the green crops that are cut and employed in this way have greater effect in exciting the secretory organs and promoting their secretions than the common pasture grass. And it is generally allowed that the urinary secretion is greatly augmented in all cases of this sort of feeding, so as to constitute one of its advantages. But as particular sorts of vegetables act more powerfully on some of the glandular organs than others, it is evident that some kind of plants may have a greater tendency to promote one kind of secretion than another, and on this account cows fed on one sort of food, in the practice of soiling, may afford less milk than on another.

The practice of soiling has also been opposed, on the ground that the animals do not thrive so well as when grazed in the pastures. But when it is considered that the more quiet and free from disturbance cattle are kept, the better they in general thrive and improve in their flesh, it is not probable that green food, when properly consumed in the sheds of a farm yard, will be less advantageous in promoting the growth and fattening of stock than when eaten in the field, where exposed to the great heat and the constant attacks of flies, and of course kept in a continual state of restlessness and inquietude. Besides, in the experiments noticed above, the cattle were



found to go on better than stock of the same kind fed in the pastures in the most favourable seasons for the purpose of grazing. And in many trials carefully made by Mr. Young, and detailed in the *Annals of Agriculture*, the results were the same. The supposition of the cattle not thriving so well under this system does not therefore appear to be well supported by facts, or to have had any foundation in the experience of farmers.

The superiority of the soiling method in respect to the economical consumption of the food cannot be disputed. In various experiments that have been made in proof of the great saving in this way, it has been found to go from twice to four or five times as far as when fed on the land; and in some trials it has been a great deal more. With grass, clover, lucern, and tares, in the trials of an able cultivator, three times as many cattle were found capable of being supported in better condition than in the pasture mode of feeding. But in those of other experimenters it has been shown to be equal to five, six, or even more times, as we have already seen in speaking of clover. In the field, it is obvious that great waste must be committed by the grass being trampled down, dunged upon, and in many other ways, especially where a great number of cattle are pastured together, most of which are avoided in the stall method: but it has been remarked that it is “an error to suppose that all the waste is in feeding in the field and none in the stalls; there is, on the contrary, a waste in soiling,” as in cases where the tares become podded, from the butt ends of the plants being coarse and in a state of decay, by lying on the ground, and of course rejected by the animals: the same thing also occurs with lucern when in blossom. In the heating of the food by its remaining heaped together, loss may likewise be sustained. Proper management in respect to the crops and the manner of employing them, as we shall see below, will, however, in a great measure, prevent waste in this method.

But whatever the waste in these different ways may be, the various trials recorded in the *Annals of Agriculture* clearly demonstrate that a vastly increased stock may be kept upon the same extent of land, in the method of soiling, over that of the common mode of grazing cattle in the fields. The great point, however, in which this practice excels that of pasture feeding, is, probably, in the immense quantity of excellent manure that is raised and provided for the production of increased crops of various kinds, and the additional improvement of the lands; while in the ordinary one scarcely any thing is contributed in this way, from the dung being scattered about the fields and dissipated by the heat of the seasons, flies, and other causes. In short, it would seem injurious rather than useful, from its blanching and tendering the grass plants in the spots where it remains, which are long in recovering and producing good grass again. Soiling with green food in summer is a method admirably calculated for producing an abundance of manure; as from the great increase in the urinary discharge in the consumption of green food in this way, and the heat of the season, the littering material, whatever it may be, is speedily converted into manure; by which



means, with proper attention, vast stores of dung may consequently be raised, where there would otherwise be none; which is a circumstance of the greatest importance, and which abundantly shows the great utility and superiority of the practice. By these means the summer produce in manure may, probably, be made to exceed that of the winter, and at the same time be superior in quality, as there is reason to suppose, that the manure produced by any kind of cattle fed in the same way, when not in a state of fattening, is much better in the summer than in the winter season. The proportion of valuable manure that the careful farmer may be capable of providing by this system of management is scarcely to be conceived, except by those who have been in the practice. In this view it is of much importance to have reservoirs for the reception of the urine, in order that it may be occasionally thrown up over the litter, and thereby promote its more speedy conversion into manure. The manure afforded by fattening animals, such as hogs and neat cattle, is in all seasons of a rich and valuable quality.

In order to ensure the fullest benefit and advantage from this system of management, the most strict attention is necessary to different circumstances; such as those of having convenient sheds and yards for the purpose; the providing suitable crops in proper succession to the proportion of stock to be kept; the feeding and managing the animals in a proper manner; and the making a full provision of materials for the purpose of litter.

As much depends on the convenience of the yards and sheds, both in respect to the economy of labour in the feeding the stock and the making of manure, care should be taken to have them upon such plants as may afford the greatest advantage in these ways. It has been a practice suggested by some, in order to save the expense of cleaning and feeding, to have the cattle in this management left loose in the yards, so as to consume the food from racks or cribs, the bottoms of the yards being prepared by marl or other similar materials, and a coat of litter applied so as that the urine may be retained, and contribute to the conversion of them into manure: but a better method is probably that of having them tied up in stalls in sheds for the purpose; for though something may be gained in the former mode in the labour of cleaning, the latter has considerable superiority in the goodness of the manure, and in the animals being kept more quiet, and less exposed to disturbance from flies. In the first method the stock should always be sorted, and those of the same age or size be fed together. A cultivator of much experience soils his horses in cheap thatched sheds, in which they have room to walk and roll; and his bullocks and cows in stalls seven feet wide, each stall holding two head of cattle, which are fastened by the necks to the sides of the stall, by which they are prevented from inconveniencing each other.

That the farmer may enter upon this management with the greatest advantage, it will be requisite for him to attend to the culture of such various crops as can be best applied in this way, on a scale amply sufficient for the purpose. In the view of early application, a full proportion of lucern should be raised on the most deep and



fertile soils; and on the better sorts of the lands that may be in the condition of fallow, clover and tare crops may be grown. These must be sown so as to come into use at different times; the first crop of winter tares succeeding to the early cut lucern; the latter put in winter tares following, after which the clover will most probably be ready, to which the third crop of tares, and the second cut of lucern, may succeed. At a still later period the spring tare may be employed: and in succession to this the third cutting of lucern will in general be ready. There are many other plants that may perhaps be made use of in this way. It will be seen, from what we have observed on chicory, that it may be had recourse to with advantage in this management; as in soils that are tolerably fertile it admits of repeated cutting. With these different crops, there will probably be seldom any necessity for the use of common cut grass, though this may be employed if there should be occasion.

On the mode of conducting the business of foddering the animals in this practice a great deal depends. One great object is never to suffer them to have too much at once, as when this is the case, from the heat of the season, it quickly takes on a degree of fermentation, and is rejected, or only picked among by the cattle; in consequence of which much waste may be committed, which would otherwise be avoided. But, besides this, it is not improbable but that the stock may thrive better by having their food more frequently, and of course in a more fresh state: and it should never, on any account, be left packed in the carts for any length of time. The best mode would seem to be that of adapting the size of the cart to the exact consumption of the stock, as in this way the whole may be conveniently distributed in the cribs or racks at once, the moment it is wanted, before it becomes unpalatable by fermentation, and the least possible loss be incurred. It is constantly necessary to watch the conduct of labourers in this particular, as they are in general much disposed to overfeed. There is another matter in this sort of feeding that should not be disregarded, which is, that of not suffering the crops that are used in soiling to advance to too great a head, as by attention in this respect the food may be more cleanly eaten up.

In this system litter becomes an object of the greatest importance; as the large quantity of urine that is made by cattle when soiled on these luxuriant sorts of green food is capable, by its moistening property, of aiding, in the hot season, the more quick fermentation of such materials, and of reducing a very large proportion into the state of manure. In this view, the attentive farmer should therefore make an abundant provision in the winter time of other sorts of materials, where a proper supply of straw cannot be reserved for the purpose. There are various matters that may be made use of in this intention, such as stubble, fern, rushes, and other aquatic plants, which may be cut and raked together in the places in which they are most abundantly produced, in order to be stacked up for future use. Leaves might also, in woody situations, be useful for the same purpose. And in addition to these vegetable matters, there are other substances that are capable of being employed with utility,



such as peat or bog earth, fresh vegetable mould, sand, and the scrapings of roads; as during the decomposition of the various vegetable materials made use of in this practice, not only much hydrogen and carbonic gas is set at liberty, but ammonia is formed in large quantities in the manner that has been already explained, which, from its action upon such earthy materials, is highly useful in bringing them into the state of manure.

There can scarcely be any doubt of the advantage of this mode of management, where that close sort of attention which is requisite in most of the operations of farming is bestowed; but in order to the complete success of the practice, it is absolutely necessary that the cattle be kept perfectly clean and free from all sorts of dirt in the cribs, racks, or other places; that there be plenty of pure water for them to drink whenever they are disposed; that the green food, of whatever sort it may be, is given to them frequently in due portions, without its being injured by keeping; and that they be turned out into the open air for a few hours in the cool of the evening during the summer season, and in the middle of the day when the weather becomes more cold. It might also be of additional advantage, where different kinds of green food can be easily provided, to vary them occasionally. By these means the thriving of the animals may be the most effectually secured.

This kind of management is equally applicable to cattle, hogs and horses; with the last it has, however, been the most common.

It is obvious, that by a judicious attention to this system many advantages may be derived to the farmer. It admits of greater extents of land being kept under both the plough and the scythe. And in the keeping of both cows and horses the saving in this method forms an object of vast importance.

In the winter fattening of animals, different methods are pursued in different districts: in some it is the prevailing practice to consume the food upon a dry sound piece of land, to which it is conveyed for the purpose. It is evident, however, that this mode can only be had recourse to, especially with heavy stock, where the nature of the ground is sufficiently dry to prevent injury being done by poaching, which is the case only on very few soils in the winter season. In some cases, especially with turnips, the crop is eaten on the land where it grows, the cattle being turned upon it. This is a practice that occasionally takes place in Norfolk with the less perfect managers. It is a great objection to this mode, that the quantity of valuable manure, that might otherwise be produced, is in a great measure lost by being spread about in the field. And it is probable that the stock does not thrive so well from being more exposed to the weather, and kept less warm and quiet, than in other methods. With sheep this husbandry may be less exceptionable, especially where the crops are drawn and put upon a close-fed dry pasture, as great improvement of the land may be effected without the danger of injury by poaching.

There is another practice often adopted in fattening cattle in the winter, which is that of confining them to the yard, and letting them have their food in troughs or boxes for the purpose in open



sheds. This, though a better method than that just noticed, is probably from the stock being left too much at liberty, less advantageous in the point of fattening than that of wholly confining them to the stalls, or what is usually termed *stall-feeding*, as by this means they are kept more quiet, and free from interruption, and of course feed more quickly, and with greater regularity; which seem to be points of great importance in this system of management.

The substances that may be employed in the way of winter fattening animals are very numerous; but the principal of the more succulent kinds are carrots, parsnips, potatoes, cabbages, turnips, grains, &c.; and of the more dry sorts, oil-cake, oats, barley-meal, rye-flour, bean-meal, and other similar materials, with various sorts of straw cut into chaff by means of machinery. In the application and management of these articles, considerable care is necessary to ensure their fullest effect. For as the art of fattening, whatever the nature of the animal may be, would seem to depend in a great degree on regularly keeping up the excitement of the system, by the use of suitable rich food, to that high pitch that tends towards indirect debility, which is probably the point most suitable for inducing rest and a disposition to sleep, which experience has shown to be the conditions the most favourable to the deposition of the fatty material in the cells of the adipose membrane; it is obvious that the fattening process may be greatly accelerated or retarded by the method of distribution that is adopted in respect to the food. If much nice attention be not bestowed in this way, great loss may be quickly sustained, especially where the more expensive dry sorts of dry food are made use of. On the same principle of promoting the full and equal excitement of the system, it will be of the greatest utility and importance not only to keep the animals warm, perfectly clean in themselves, and free from all kinds of filth; but also their sheds, stalls, mangers, troughs, or other places from which they take their food; as by such means that constriction of the hide, which is the sure indication of their not thriving in a proper manner, may be avoided; and at the same time that disgust, which probably arises in consequence of the parts of the food left upon the places where the cattle feed taking on or running into a state of fermentation, be prevented; and of course the feeding of the animals proceed in the most expeditious and uninterrupted manner. And where both moist and dry food are given at the same time, it may be necessary, in the view of promoting the more quick fattening of the cattle, to combine them in such proportions, according to the constitutions of the animals, as that the too laxative effects of the former may be kept in order by the constipating powers of the latter, and thus a due balance be preserved, which is the state most adapted to the purpose of fattening. But besides this effect, the combining of dry food with those rich and juicy substances, which have their nourishment in a close or concentrated state, may be advantageous in another point of view, which is that of affording a due degree of distention to the stomach, a condition that is also probably necessary to the expeditious fattening of animals. Without this, that sort of fullness or satiety which induces the animals to



take their rest, cannot, perhaps, be so completely produced. It is on this principle, that in man a full meal cannot be made on flesh meat alone without the assistance of bread, or some other similar substance. On this ground, hay or cut dry meat must therefore be constantly useful in stall-feeding, with such rich roots and plants as are not capable of being employed so as to produce the necessary degree of fullness.

In order to accomplish these different objects in the most perfect and effectual manner, it is essential that the closest attention be bestowed by the farmer to see that the stock, whether foddered in open sheds or tied up in stalls, be regularly fed, adapting the proportion of food employed each time to the state of the digestive organs of the animal; cautiously avoiding, as much as the nature of the business will admit, either giving too much or too little, as from both extremes injury may be produced: but it is better, as fattening animals are very nice, to let them have rather too little than too much; for, where any disgust is occasioned, they never feed so well afterwards. It is useful also, on the principle formerly explained, to vary the kinds of food frequently, so that there may be less danger of their losing their beneficial effects. This circumstance is much attended to in other countries; fattening stock that is neglected in these respects never succeed well, or afford the farmer a just profit. It is consequently of vast importance to have this business conducted by a person accustomed to the practice. The cattle should likewise be kept constantly free from standing in any sort of dirt, by having the dung daily removed, and their standings swept out quite clean, and well littered down with dry clean litter of some of the kinds that have been already recommended, so as to prevent any sort of nastiness from adhering to their skins.

To do this completely, as much should be made use of as can be converted into manure, probably the proportion of from one to two or three tons to a beast may not be too much, as the dung will amply repay its expense in the improvement which it affords to the lands. And by this, with the above means, all sorts of disgusting smells may be wholly removed. It is also useful in the intention of fattening to have the animals sheltered and kept in a due degree of warmth, without being too hot; as where the heat is considerable, there may be disadvantage by too much perspiration being excited. Where it is necessary to make use of cut dry meat, the best practice is probably that of keeping some of such food always in the cribs or mangers, so that the animals may be induced to take it at pleasure.

The business of fattening in the stall, or the farm yard, usually commences on the decline of the pasture and after-grasses, towards the latter end of October, continuing through the whole of the winter, until about the beginning of May. When succulent food is made use of with cut dry meat, which is in general a more profitable method to the farmer than that of having recourse to corn and oil-cake, carrots, parsnips, and potatoes would seem to stand the highest as articles for this purpose; cabbages and turnips having been found inferior in their fattening qualities; the two first are equal to almost any sort of food in this view, being capable of fat-



tening large cattle. The most general practice is to use these roots and plants without any preparation, except that of being sometimes cut, sliced, or chopped, giving only a small proportion at once, three or four times in the course of the day, in cribs or mangers properly contrived for the purpose; proper supplies of cut straw in mixture with hay being in most cases provided and given in the intervals of such feeds. In this method less water will be required than when dry meat is wholly made use of. This mode of feeding must be pursued with as much steadiness and regularity as possible, varying the kinds of moist food occasionally where it can be conveniently done. A great deal of the success of the practice rests upon proper attention to these circumstances. Some have supposed that great advantage may be derived from the application of fire in the preparation of some of these roots for the feeding of the animals. In the trials of an intelligent cultivator, the Rev. Mr. H. Close, turnips were found to answer well in the feeding of cows in combination with cut chaff when prepared by means of steam; and in various experiments detailed in the *Annals of Agriculture*, potatoes have been found to be better suited to the feeding of horses and some other animals by undergoing the same process. This mode of preparation is probably much more necessary in the potatoe than the turnip, as we believe, from trials that we have made, that they not only agree better with the animals, but are more fattening when given in this state. Besides, there is much less loss sustained in the operation of steaming in the potatoe than the turnip. However, as there must constantly under this mode of preparation be a considerable expense in labour and fuel, it is better to avoid it wherever the nature of the vegetables will admit of being made use of in their raw state, which is certainly the case with the turnip and several other vegetables noticed above.

The proportions of these different sorts of food that an animal will consume in any given time cannot be easily ascertained, as much must depend on circumstances—the modes of feeding, the size of the animal, the nature of the season, and various other causes.

In some trials carrots have been found to be consumed in the proportion of about ten stone per day for an ox of sixty stone, cut chaff or hay being given in addition. As the parsnip contains an equal if not larger proportion of the nutritious principle, nearly a similar quantity of that excellent root may be necessary; but we believe experiment has not yet shown the exact difference in the fattening properties of these two roots. The latter can however only be cultivated to advantage on a deep rich soil; but in such cases it should never be neglected. An acre of either of these roots would complete the fattening of two such beasts as the above, if taken from the pastures in a half-fattened condition. These two roots and the potatoe, probably, approach the nearest that of oil-cake in their fattening properties, but are certainly inferior to that substance.

The experiments made on potatoes in the intention of fattening animals have been sufficiently numerous to show that they are capable of that application with great advantage. In the trials of Mr. Abdey, with small Welsh and Scotch runts, the consumption per



day was about a bushel each, given in their unprepared state, with a quarter of a truss of hay. Their powers of fattening in these trials appear to much advantage. When given in their raw state, hay or some other sort of dry food is, however, constantly necessary to correct their laxative quality. And when given after being prepared by fire, it is the practice of many to mix them with cut chaff.

Where the cabbage is made use of, the consumption is in general found to be something less than one-fifth the weight of the animal in the course of the day: therefore an animal weighing sixty stone consumes in the ratio of twelve stone each day. In the trials of Mr. Turner, an ox of eighty stone was found to eat fifteen stone of cabbages with half a stone of hay. And in respect to their power of fattening, it was found that oxen put to them in low condition about November became in a state of fatness fit for sale in the following March, weighing eighty stone; usually improving in the course of four months in value about five pounds ten shillings. In this proportion, an acre of thirty tons of this crop would be adequate to the fattening of three beasts of the above size.

Grains can only be made use of in this way in particular situations, as near large towns, where they can be obtained at a reasonable rate. Those procured from distilleries are found the most beneficial in this use. The quantity made use of for moderate-sized beasts is usually from a bushel to a bushel and a half three times in the course of the day, hay or cut dry food being given between the periods of feeding with these substances. Grains seem to be much less powerful in their fattening properties than any of those articles that precede them.

But turnips, though very frequently employed in this manner, are greatly inferior to cabbages, as, besides their being more liable to injury, they probably possess the fattening property in a less degree than any of the substances that have been mentioned. The proportion in which they are consumed by the fattening animals has by some been found to be something more than a third of their weight, but by others about a third in the day. In other experiments, an ox of from seventy to eighty stone has been ascertained to eat something less than three hundred weight in the course of the day, besides chaff and hay; and small cows of about thirty stone, one hundred weight and three quarters in the same space of time. An experienced agriculturist has found, that when consumed in stalls or sheds, an acre of good turnips will "completely winter-fat an ox of fifty score," besides affording manure for an acre and a half of land; but if fed upon the land, two acres will not fatten one so well, and the dressing will be partial and of little value. Much dry food is constantly necessary during the use of this sort of food in order to the expeditious fattening of the animals.

The turnip is often employed in the fattening of sheep; and in this application it is frequently advantageous, where the management is conducted with judgment: but to derive the greatest profit from this practice, it is probably the best method to only make use of them for such sheep as are in a considerable state of forwardness; as such as are poor when turned to this sort of food are seldom found



to pay well for it. Every farmer who has applied turnip crops in this way must have found this to be the case. Where the soils are sufficiently dry, the best method of consuming them may be on the lands, by means of hurdling; but, under the contrary circumstances, they may be drawn and eaten upon a dry piece of sward. It is the practice with good farmers, in many cases, to have recourse to oil cake, oats, barley-meal, pollard, bran, malt-dust, and other matters of the same sort for the fattening sheep when at turnips; as by these means the watery quality of that food is corrected, and the fattening of the animals, of course, much promoted. It is perhaps only the best sort of sheep that can repay the expense of this system of fattening. These articles are not however absolutely requisite in the fattening of sheep on this root, as vast numbers are made fat without them; but they greatly promote the process. And it is often useful to have recourse to other sorts of dry food with them, such as hay, cut chaff, or other similar substances, which should be placed in racks, cribs, or troughs made for the purpose, the latter of which should be so guarded by boarding as to prevent the wind from blowing such light substances out of them. There is another point that deserves attention in the fattening of sheep on turnips, in order to prevent the waste which must otherwise be incurred, which is that of letting the portions of turnips that are left by the fattening stock be cleanly eaten up by lean followers.

Of the dry kinds of food employed in the fattening of cattle, there is, perhaps, none equal to *oil-cake* in the property of fattening. It is, however, linseed cake that must be employed in this way. The late advances in the price of this article have probably rendered it incapable of being made use of with much profit except in particular cases, and where manure is a principal object. With this sort of food, as well as those that have been noticed above, it is also the common practice to give some other sort of meat, such as hay, cut chaff, and other substances of the same nature. In this mode of fattening, some begin by giving, to a beast of a hundred stone, two cakes per day, of about six pounds each, for six or eight weeks, and then increase them to three, till the animals become fat. In addition to the cake, from half a stone to a stone of hay is given each day: the whole consumption in cake being about 21 cwt., and in hay 26 cwt.; which, at the prices previous to the late advance on these articles, rendered the expense of winter-fattening an animal of the above size something more than seven guineas. Lean cattle of the smaller kinds have been made perfectly fat in the course of eight or ten weeks by this substance, in the trials of Mr. Moody. The cake, in this application, is broken down into small parts, and frequently blended with the chaff or other substances that are made use of with it. On the continent, according to Mr. Young, linseed cake is sometimes exhibited in a liquid state, being diffused in hot water and drunk by the cattle, hay and other substances being given at the same time. In the Lincolnshire Report a method is suggested, of giving cake to cattle while in the pastures, in a small proportion, with great success; a practice which may be applicable where the cake-fed beasts are not fully fattened for sale in the early spring



months. It is an advantage in fattening with this and other similar substances, that the animals may be completed with them at much more advanced ages than in other modes.

The use of linseed oil and bran has been attempted on the same principle as that of cake, but probably with less success. The consumption in this method for beasts of the smaller size is something more than half a peck of bran three times in the day, with a third of a pint of linseed oil well stirred into it; with this good hay or cut chaff is usually given. This method is attended with more trouble than that of cake-feeding, without any superiority in the effect. It can only be employed when the oil is cheap.

When sheep are fattened with cake, they require it to be reduced into a much finer state than for beasts, and it may then be mixed with bran or other similar substances, and put in the troughs or cribs.

Oats are excellent for stall-fattening cattle, but the price has lately been too high for their being made use of to any extent in this way. They are mostly given in the straw when applied in the fattening of cattle.

Bran, in mixture with pea or other sorts of meal, has likewise been found useful in stall-fattening, as well as barley and other meals, in combination with various substances of other kinds; but their use must constantly be regulated by the prices which they bear at the market.

It has long been contended by some, that food in the state of acidity is the most advantageous in the feeding and fattening of swine, while others have as strenuously maintained the contrary position. The point has not, however, so far as we know, been fully decided by any fair experiments. That there may be something in it, seems probable from the circumstance being so frequently noticed, and from Mr. Young having found the same principle applied in the fattening of cattle in France, where they finish the process by the use of sour rye paste, brought into a liquid state by the addition of water, and afterwards rendered sufficiently thick by some kind of cut meat. The principle on which this depends seems involved in some difficulty; as it has been long a popular notion, that acids have a directly contrary tendency. It would appear, however, not improbable, but that acid substances may have some power in strengthening the digestive organs, and thereby promoting the consumption of a larger proportion of food in a given time, in consequence of which the animals become fat more quickly.

Besides these substances, various others have been employed in particular situations for the purpose of fattening animals. The wash of malt-distilleries, which has long been principally employed in the fattening of hogs, has now been found applicable in the stall-feeding of cattle. The method of using it is in conjunction with some farinaceous substances, such as those that have been already mentioned. It is then given in small proportions, three or more times in the day: a little hay or straw being given them to enable them to chew the cud. In the West Indies, Mr. Millington found me-



lasses to possess an expeditious fattening quality, when joined with other articles of the common food of cattle. It was made use of in his trials in the proportion of from half a pint to a pint, twice a day, in mixture with different farinaceous or mealy substances: and, where these were not in use with various kinds of dry food, such as cane-tops, and guinea grass well dried by exposure to the sun, and with oil-cake. These are moistened with the same quantity of molasses, to which water with a little salt is added. With these articles a little hay, or not too succulent green fodder, was employed. Their effects in fattening poor worn-down oxen were found very considerable. They are not, however, from their great expense, capable of any general application in this way.

Whatever the nature of the food may be that is employed for the purpose of fattening animals in the yard or the stall, the greatest care is necessary to see that it is regularly given to them, that they have it in due proportion and sufficiently varied; that pure water be amply provided, and that they have litter so as to keep them perfectly dry and clean. Where this sort of business is conducted on an extensive scale, it is also of the greatest utility to have a machine for the occasional weighing of the cattle as they advance in their fattening, as without such assistance it is but few persons who are capable of judging whether they go on in a profitable manner or not. But, by weighing them from time to time, at the distance of every eight or ten days, in the morning before they are fed, this may be correctly ascertained; and where they do not fall off, or do not advance in a sufficient degree to the preceding weighings, such changes may be made in their food, water, and management, as are the most likely to promote their fattening in the most perfect manner.

There is another scheme of feeding that may be necessary to be considered in this place, which is that of fattening lambs in the house for the purpose of early sale. This is a practice which can only be undertaken with advantage in situations at no great distance from large towns, where there is great demand for early lamb. In order to conduct this sort of fattening with profit and success, a *lamb-house* or *suckle* of proper dimensions must be provided. It is found from practice that a range of building from sixty to seventy feet in length, and fifteen or eighteen in breadth, with three or more coops or divisions of different sizes at each of the ends, for separating the lambs according to their ages, is sufficient for containing and conducting the business of from one hundred and sixty to one hundred and eighty lambs. That the lambs may be enabled to find their mothers with facility, the ewes, when they are separated from them, should be kept apart by deal hurdles in the middle of the house, so that they may be convenient for the lambs in the coops at the ends.

After these arrangements have been made, a suitable breed of ewes for the purpose should be provided. The most early ewes of the Dorsetshire breed are the most proper for this management. And there is another circumstance, that demands attention in this system of fattening, which is that of having such ewes as produce



lambs that die of a fine white colour in the flesh, or what the butchers term *fair*.

The ewes, after being provided with due attention to these circumstances, are to be carefully kept during the day-time in a warm pasture, and housed in the night. They should be fed with brewers' grains and good green rouse hay, where there is not plenty of grass, as it is of much consequence to keep them well before the time of lambing as well as afterwards. They usually begin to lamb a little before Michaelmas, and when twenty or thirty lambs are dropped they may be put into and confined in the house. And in order to their feeding in the most perfect and expeditious manner, it is necessary that the house be kept constantly well littered with clean wheat-straw. All the dirt and nastiness that may arise or adhere to the coops, hurdles, or other parts, should be often carefully removed and washed away, as without care in this respect the lambs never thrive well. It is likewise necessary to provide a proper supply of calcined chalk, both in the lump and in powder, in order that by licking it they may correct the superabundant acidity of the stomach, and thereby prevent the tendency to looseness, and preserve themselves in health. Proper supplies of fresh wheat should likewise be placed in a shallow trough every day for their feeding upon. And as they are apt to suck any thing that comes in their way, a little clean wheat-straw should be put, with the ear ends downwards, in a rack within their reach, for them to nibble and eat of. If there be pitch-marks on the ewes, they should also be clipped out. The foot rot and scab are likewise to be well guarded against.

The method of management that is usually adopted in the *suckling-house* is this: "the mothers of the lambs are turned every night at eight o'clock into the lamb-house to their offspring. At six o'clock in the morning these mothers are separated from their lambs and turned into the pastures; and at eight o'clock such ewes as have lost their own lambs, and those ewes whose lambs are sold, are brought in and held by the head till the lambs by turns suck them clean: they are then turned into the pasture; and at twelve o'clock the mothers of the lambs are driven from the pastures into the lamb-house, for an hour, in the course of which time each lamb is suckled by its mother. At four o'clock all the ewes that have not lambs of their own are again brought to the lamb-house, and held for the lambs to suck; and at eight the mothers of the lambs are brought to them for the night."

"If an ewe gives more milk than its lamb will suck, the superabundance is given to the twins, or to any other lamb whose mother may not be able to furnish it with sufficient food. The shepherd must in this case hold the ewe, or she would not suffer the strange lamb to suck. From their timid nature, it is extremely essential that they should be kept free from every species of unnecessary disturbance."

In order to enable the ewes to support the great exhaustion of this system of management, they are kept plentifully supplied with different sorts of food, such as clover, rye, tares, clover, and other similar vegetables, and when these are not capable of



being provided in plenty, brewers' grains are given in their place in troughs, and a proper supply of fresh green rouen hay, in racks. This is requisite not only for the support of the ewes, but that a full supply of milk may be provided for the lambs, and the danger of their being checked in their thriving avoided; as where the contrary is the case, no sort of feeding can afterwards bring them into a fattening state.

The lambs are retained in the houses, under this method of feeding, till they are in a proper condition for the butcher; at which time such as are about eight weeks old and fully fattened are drawn out for the market, which in general fetch from two to four or five guineas a-piece, according as they are more early. December and the two succeeding months are the dearest, as at other seasons they seldom fetch more than one-half the price. It has been observed that the salesmen and butchers in London find that such lambs as have sharp *barbs* on the inside of their lips die of a deep colour, and those whose *barbs* are naturally *blunt* certainly turn out *fair* meat.

The chief objects in this sort of fattening are those of attending to the regular feeding of the ewes, the varying of their food with propriety, and keeping the house perfectly clean and sweet.

## SECTION XXII.

### *Cultivation of Grass Land.—Planting Fruit and Timber Trees.*

THIS is a practice which has lately been much more attended to than probably at any former period: the profit and advantage of covering different sorts of land with trees of the fruit, timber, or other kinds, according to circumstances, having begun to be better understood, and of course to gain a greater interest with those extensive proprietors who have the best means of carrying such plans into execution.

It is obvious that on the drier sorts of deep, friable, strong, loamy, and many other sorts of soil, in particular situations, fruit-trees of different descriptions, but particularly the apple and pear, may frequently be planted, when either in the state of tillage or pasture, with great profit and success. And that in the less deep lands, of the same kind, with dry rocky subsoils, other sorts of fruit-trees may often be raised with advantage: while on the steep unproductive waste lands, that can neither be cultivated with much benefit under the system of corn or grass, trees of the timber or other sorts admit of being planted with very considerable profit; often from two or three, to eight or ten times the amount which they would afford under any other method of management.



It has been well observed, that waste and barren lands, in most situations, may very conveniently be improved by planting trees on them. There are few spots which would not admit of being brought into culture in this way, under particular circumstances; and there are innumerable tracts, of vast extent, on which it would be much more profitable to the owner to plant with trees, than to attempt any other mode of improvement. “Wherever the soil is dry and infertile, or where its chief or only produce is heath, or where it is full of rocks and stones rising to the surface, or if it be a stiff obdurate clay, having little surface-produce; and in general, in most cases where the soil is poor, if not in the very near vicinity of a town, it may be converted into plantations, if it can be freed from hurtful water, with greater profit than any other improvement it could admit of, unless in very particular circumstances, even where it may admit of being brought, *in time*, into cultivated ground. Where the surface-produce is naturally small, perhaps nothing could be so economical, as, *in the mean while*, to fill it with trees; because these, if judiciously chosen, not only yield a greater profit than could be drawn from any other kind of produce, and afford conveniences for houses, and other accommodations for inhabitants and for manufactures, but the ground itself, while the trees continue to grow upon it, undergoes for the most part a gradual amelioration, which it would not have done in its natural state, and admits of being more easily improved when the proprietor can find leisure to undertake it, than it otherwise would have done.” Others recommend that every inch of such barren waste lands as are not capable of cultivation by the plough, or of being usefully applied in the state of sward, should be converted to the purpose of raising plantations, especially those bleak and exposed tracts on the sides of mountains, and on the banks of the sea. It is however the advice of an attentive observer, that large plantations or coppices for profit, should not be made on good land, always of much more value for corn or pasturage, but either on moist land of small value, upon a clay or marl bottom, where timber often grows well, or rather where such land abounds, upon precipices, and sides of hills impracticable to the plough; and where it often happens the land unplanted is of little or no value.” There are likewise situations in the more warm and less exposed parts of almost every district which are proper for admitting this sort of improvement, on account of their incapability of being converted to other uses; such as the narrow corners of fields in the state of tillage, and the hedge-rows of those in the condition of grass. In short, there is scarcely any portions of land so poor, barren, rocky, or unproductive, as not to admit of this sort of improvement, provided trees adapted to the nature of their soils, and proper modes of planting be practised.

In order to render this sort of management more clear and satisfactory, we shall consider it as applicable in the cultivation of fruit-trees, timber, and coppice, or underwood.

*Fruit-Trees.*—The planting of trees for the purpose of producing fruit of different kinds, in many districts, forms a considerable part of the profit of the farmer. This is the case in Herefordshire, De-



vonshire, and other counties where the business of making cider is carried on in an extensive manner; and in the county of Kent fruit-trees are often planted with the intention of deriving profit from the produce.

In those districts where cider constitutes a principal object of the farmer, the planting of apple-trees becomes a business of great importance, and requires particular care, in order to keep up a constant succession and afford proper supplies of fruit for the purpose. This may be done by consulting catalogues, such as those of Crocker and others.

It is only in those sorts of soil that are of the more dry kind that trees of this description can be raised with advantage. It has been remarked, by an intelligent cultivator, on an extensive scale, that the fruit liquors of Herefordshire have “always been supposed to derive their excellence from some peculiar quality in the soil which produces them; but that a preference has been given to soils of opposite kinds by the planters of different ages. Those of the last century uniformly contended in favour of a light sandy loam, and on that their finest ciders were made: at present, a soil of a diametrically opposite quality, a strong red clay is generally preferred. Much of the soil which is there called clay is properly argillaceous marl; and some of it contains a large portion of calcareous earth, and effervesces strongly with acids. He has found this soil to form the substratum of some orchards much celebrated for producing ciders of the first quality. It appears to have the effect of mitigating the harshness of rough austere fruits; and that, as the trees grow with great luxuriance in it, it is, perhaps, of all soils the best calculated to answer the wishes of the planter; but that the strongest and most highly-flavoured liquor which has hitherto been obtained from the apple is produced by a soil which differs from any of those that have been mentioned—the shallow loam on a lime-stone basis.” There can be no doubt but that the apple-tree is capable of succeeding in soils of very different qualities, provided they be perfectly free from stagnant moisture; but we have found from many trials that in stiff retentive soils, where the bottom is wet, they begin to grow mossy, and decline in the course of a few years. It has been found that the early fruits obtain their greatest perfection in a sandy soil, and the late ones answer best when they are planted in a strong loamy or clayey one: the more valuable fruits, as the styre, hagloe crab, and golden pippin, delight most in the light sandy soils. And it is a fact fully determined, that cuttings from the same tree grafted upon similar stocks, but planted in different soils, produce different liquors. It is also admitted that liquors of the strongest body, and which keep best, are produced from trees grown in clayey soils.

Pears are much less particular in respect to the nature of the soil on which they are planted than apples, as they are found to succeed and afford fruit in almost every sort of land.

The nature of the situation and aspect that is most favourable and proper for the apple is likewise equally involved in difficulty: some contending for high, others low situations, as well as for different aspects. The intelligent writer just mentioned, however, ob-



serves, that “the apple-tree succeeds best in situations which are neither high nor remarkably low. In the former its blossoms are frequently injured by cold winds, and in the latter by spring frosts, particularly when the trees are planted in the lowest part of a confined valley. A south or south-east aspect is generally preferred, on account of the turbulence of the west, and the coldness of the north winds, but orchards succeed well in all; and, where the violence of the west wind is broken by an intervening rise of ground, a south-west aspect will be found equal to any.”

It has been suggested, that the more early sorts of apples should be planted in southern aspects, and those of the later kinds in northern ones; as by these means the former may be rendered so forward, and the latter so protracted as to be less in danger of injury. And where the land of a farm will permit, it is supposed that advantage may be derived from having this sort of trees planted in different situations in respect to exposure; as in this way the chance of escaping blights will be greater, as where one fails the other may succeed.

In regard to the choice of fruits for every difference of situation, a writer of experience has remarked, that great attention “should be paid to select such as are sufficiently early to ripen well in it. A cider-apple may be safely pronounced to be too late for the situation it occupies, when it does not become yellow before the end of October; and he does not know any disadvantages attending an early maturity, provided the kinds of fruit be capable of being kept a few weeks. An opinion prevails, that the liquors obtained from all early fruits are without strength or body; but the strongest cider is produced by one of these—the styre. In cold and favourable situations, those fruits will best repay the planter which, in their general character, appear nearly related to the native kind, or crab; for though the flavour of these be austere and ungrateful to the palate, the ciders produced from some of them, when they have been thoroughly ripened, are often found smooth and generous. But he would recommend the grafts to be taken from an improved crab, and not from a degenerated apple; for the former will possess much of the hardiness and vigour, whilst the latter will often inherit the debility and diseases of the parent tree.”

Different methods of planting are adopted in different districts; but, according to Mr. Knight, the Herefordshire planters generally perform the business in the “quincunx form, or in straight lines crossing each other at right angles. The former method is preferred in the hop-yard and pasture, and the latter in tillage, being less inconvenient to the ploughman. But it appears to him, that any given number of trees planted near each other in rows, with wide intervals, would be less injurious, either to pasture or tillage, than in either of the preceding methods. The trees in each row should, in this case, be of the same variety of fruit, that no one, by possessing greater vigour and luxuriance, might overgrow and shade another, and that the whole row might appear a continuation of the same tree. The intervals between would afford considerable space for the plough or pasture; and every tree, having room to extend



its branches on each side, would be more protected than injured by its neighbours, and would attain nearly or quite as large a stature as if entirely insulated. The cider-maker would also be enabled to collect with convenience each kind by itself, and might afterwards mix them according to his judgment or caprice. Unless an orchard be very large, not more than five or six kinds should be planted in it; and if some of these be such as blossom early, and others late, the planter will have as good a chance of an annual supply of fruit as a larger number of kinds would afford him."

It is conceived, by the same author, that "the distance between each row, as well as the space between each tree, must depend on the situation and soil. When the former is high and exposed, the trees should be closely planted, to afford each other protection; and, when the latter is poor and shallow, their growth will of course be diminished, and they will consequently require less room; but in low and sheltered situations, and deep rich soils, where the trees are little exposed to winds, and attain a large size, wider intervals must be allowed them. In the former instances, a distance of twelve yards between each row, and half as much between each tree, will be sufficient; in the latter, twenty-four yards between each row, and eight between each tree, will not be found too much, particularly if the ground is intended for tillage after the trees have grown to a considerable size. An opinion rather generally prevails at present in favour of planting single trees, at twenty or twenty-five yards distance from each other, on arable grounds; and specious reasons may be offered in defence of this practice: the roots, as well as the branches, are at perfect liberty to extend themselves in every direction; but the latter are every way exposed to the storms of autumn and to the cold winds of the spring; and trees of more hardy kinds than the apple are well known to grow much better when planted near enough to afford each other protection than when totally insulated. It may be supposed, that trees growing in distant rows will not regularly occupy the whole surface of the ground with their roots; but those always extend far beyond the branches, and will meet across very wide intervals. The growth of every insulated tree is more low and spreading, and consequently more injurious to corn or herbage growing under it. Where the mode of cultivation will admit, the rows should always extend from north to south, as in this direction each part of every tree will receive the most equal portions of light and heat.

But the distance of the trees when planted in the field is frequently made much greater than the above, as from twenty-two to twenty-four or five: and some advise the distance of sixty feet every way as the most proper and advantageous. It is probable, however, that in planting at great distances there may be inconvenience in respect to the produce, from the trees being more exposed to the cutting winds and frosts.

It is found that "apple-trees are generally the most productive of fruit when they are situated near the fold-yard, and the ground in consequence much trodden and manured by the cattle in the winter. The ground in which old apple-trees have grown is esteemed



very unfavourable to young ones. When from contiguity to the house an orchard is planted in this kind of ground, the pear and apple should be made to succeed each other, as has been judiciously recommended by Mr. Marshall ”

Experience has sufficiently shown that trees of this sort are commonly “raised with most success, and at least expense, in an old hop-plantation; the ground under this culture being always well tilled and manured, as well as fenced against all kinds of cattle. Considerable advantages may be obtained by planting twice the number which are to remain of trees in each row, using two kinds of fruit, and putting each alternately. The kinds which succeed best may be left, and the other be removed to the tillage. Trees of a large size may be transplanted, without the least danger, in the autumn, particularly if the roots be shortened in the preceding winter. The subsoil of the ground which suits the hop is not unfrequently too moist for the apple, a defect rarely removed by draining. But where a hop ground is wanting, trees may be raised in tillage or pasture; but the expense of defending them properly will be considerable, particularly in the latter, in which, though ever so well defended, they usually make but a slow progress. In tillage-land the least expensive (and perhaps the best) method of raising apple-trees, will be to exclude every species of cattle except sheep and pigs, and to defend the trees only with small branches bound round their stems, as in the broom or besom of the farm-house. This fence must begin close to the ground, and rise to a greater height than sheep or pigs, or the chains of the horses in ploughing can reach; and to preserve the bottoms of the stems from injury by the plough, a strong oak stake should be driven into the ground on each side of every tree. The small branches which defend the stems will require to be replaced every other year; but this will be done at a very trifling expense.” In the pasture-method of planting, formality of the row may be dispensed with; but the trees will succeed much better if three or five be planted near each other with wide intervals, than if each stand entirely alone.

In regard to the method of removing and planting the crab-stocks or apple-trees, the latter of which is mostly used in the field at the time when they first begin to bear fruit, in the former case the stocks are grafted. It is frequently the case that too little attention is bestowed “to leave the roots as long, and as little injured as possible, and not to plant them deeper than they formerly grew. The soil round each tree should be dug eighteen inches deep, and four or five feet wide, placing the sod, if the ground be pasture, in the bottom of the holes, as recommended by Mr. Marshall. If the holes, in this case, be made six months before the time of planting, and if a small quantity of rich mould be mixed with that of the field, immediately round the roots, it will much accelerate the future growth of the trees; but it will rarely be advisable to make use of any very delicate or highly cultivated fruits when this method of planting is adopted. The branches of the trees, whether grafted or not, and wherever planted, should be much retrenched: and the mould may be raised a few inches round the stems, to prevent their



being shaken by the wind. A stake of each will also be of much service: but great care must be taken to prevent the bark of the tree receiving injury by being robbed."

There is another circumstance, especially where the land is somewhat inclining to moisture, that demands attention, which is that of not placing them too deep. If so planted as to be capable of resisting the wind, they cannot be planted too near the surface. Much mischief is frequently done by deep planting, as the apple-tree is particularly liable to be destroyed by the stagnation of water about its roots.

In making a plantation the autumn is the most eligible season; but if from any cause the planting be delayed till spring, the trees will succeed perfectly well, if the soil or succeeding season be not remarkably dry. When the trees have once taken root in the hop plantation or tillage, they will not require any thing more than protection from the planter; but in the pasture the ground should be annually dug three or four feet wide round each, during the first four or five years after they are put in.

Apple-trees being naturally very full of branches, frequently require the operation of pruning; and, when properly executed, great advantages will be found to arise from it: but, as generally performed, the injury the trees sustain is much greater than the benefit they receive. It has been observed that "the ignorant pruner gets into the middle of the tree, and lays about him to right and left, till he leaves only small tufts of branches at the extremities of the large boughs. These branches, now receiving the whole nourishment of the tree, of course increase rapidly, and soon become, when loaded with fruit or snow, too heavy for the long naked boughs, which are of necessity full of dead knots from the former labours of the pruner, to support. Many hundred trees annually perish from this cause. It is believed, the present system of pruning ought to be precisely reversed, and that the pruner should confine himself almost entirely to the extremities of the bearing branches, which are always too full of wood, and leave the internal part of the tree nearly as he finds it. Large branches should rarely, or never, be amputated."

The principal reasons of trees of this sort not producing fruit as regularly as crops in any other cases, are the effects of frost in the spring months, as in April, and those of blights in the following. The former is found to be most dangerous when it comes on suddenly, while the *blow* is moist. It has been remarked by the author of the *Philosophy of Agriculture and Gardening*, "that the early blossoms of apple and many other trees are frequently destroyed by an excess of cold; and Mr. Knight asserts, that the haziness of the air which usually accompanies warm days and frosty nights, with a north-east wind, in the spring, is injurious to the blossoms of every tree, and particularly so to that of the apple; for the warmth of the day hatches the eggs of the insect which breeds in it, whilst the coldness of the night, by checking the progress of the sap, retains the blossom in its half expanded state to form a nidus for it. This insect, which assumes the winged state in



July, is a small brown beetle, and that it then probably lays those eggs on the trees, which, if the succeeding season be unfavourable, prove destructive of the future crop of fruit." And it is further observed; that "the leaves and blossoms of the apple-tree are sometimes entirely destroyed by a numerous tribe of caterpillars, some kinds of which become moths in the summer and autumn, and others in the succeeding spring, as well as by a minute insect of the cochineal tribe." The same writer adds, that "the blossoms of the apple appear to fail not unfrequently from want of impregnation, when the weather is unusually hot and dry, or when cold winds prevail; as he has often observed the *farina* to wither and die on the *an heræ* in such seasons. In each of these cases he has always seen those trees most productive, which, having had the good fortune to escape the desolating hand of the pruner, were moderately full of wood, and capable of affording their blossoms some protection from frost and cold winds, or excessive heat."

After the apples have remained on the trees till they are become in a proper state of ripeness, they are then to be carefully gathered, and properly separated, as the goodness of the liquor in some measure depends upon this being properly performed. It has been advised, that "those whose rind and pulp are tinged with green or red without any mixture of yellow," as that colour disappears in the first stages of fermentation, should be kept perfectly separate from such as are yellow, or yellow blended with red. The latter sort, after being left on the tree till sufficiently ripe to fall without much shaking, "are alone capable of making fine cider." When thus separated, they should be kept till quite mellow, which is best done by exposing them in a thin layer to the influence of the sun and air in some convenient covered situation, as by that means the liquor will be stronger and the danger of an unpleasant flavour be avoided. No precise rules have been laid down for ascertaining the most advantageous degree of maturity to which they should be brought for this purpose, but it is suggested that as long as they become more yellow without rotting they may improve. In this state they are fit for being converted into cider by the proper success. This may be seen by consulting Mr. Knight's and Mr. Crocker's Essays.

There is little difference necessary in the method of planting pears from that which has been laid down for apples; except in their being best raised on their own sort of stocks, their requiring wider intervals from their taller growth, and being planted, whether in the orchard or in the tillage-land, at much greater distances; in the former at not less than eighteen yards distance in the rows, and eight or nine from tree to tree, and in the latter not less than twenty-five or thirty between the rows. The form and stature of the different varieties must also be regarded, and only one sort be planted in a row. And, as in some sorts, the fruit is only produced on the outsides of the branches exposed to the sun and air, while in others it is in every part of the tree, it is recommended that the former sort should be planted at greater distances than the latter kind. From the irregularity of the ripening of the fruit, a great number of trees of the same sort is necessary to afford a sufficiency for being ground at a time.



It has been found by the same writer, that the produce of an acre of land planted with apple-trees is nearly a third less than the same extent planted with pear trees; but then the apple-tree begins to bear much earlier, and cider is justly a preferable liquor to that of perry.

In respect to the loss in the pasture where the land is closely planted with apple-trees, though it may be considerable, it will seldom be more than one-tenth of the value of the fruit. Besides, the grass produced in these situations is highly valuable from its coming early in the spring when much wanted; and if kept closely fed down, and prevented from becoming coarse, will support much stock.

In short, it is remarked by Mr. Knight, "that such lands as produce but a scanty herbage may frequently be converted into excellent orchard ground. As an instance of the advantage in this way, an orchard of this sort, which for the last thirty years has afforded a produce not much less than four hundred gallons the acre, would not, it is supposed, if the trees were wholly removed, supported two small sheep during the year with facility. The soil is of the indurated, deep, stiff, clayey kind, which, it is conceived, would be less worth twelve shillings an acre as a pasture, than it is worth three pounds an acre as an orchard."

It is added, that there are in this island many hundred thousand acres equally capable of being improved to the same extent by planting with apple and pear trees, which might be effected at a very small expense, from the trifling value of the plants."

The same writer has likewise suggested, that by distributing a few trees of the apple and pear kind thinly over the meadow and pasture lands in all those districts where they could be planted with success, but little injury would be done to the herbage; while a sound palatable liquor would be provided for the whole of the population employed in the business of husbandry, and in productive seasons a supply afforded for other purposes; beside advantages derived in the saving of barley, as well as the prevention of so many acres being cultivated under the hop system.

*Timber-Trees.*—In the raising of timber or other forest-trees almost every thing depends upon properly adapting them to the particular nature of the land, its being in a suitable state of preparation for their reception, and the planting being performed at a proper season, in a perfect manner, and at proper distances, according to the nature of the trees and situation. There are likewise a few other circumstances that demand attention in conducting this business in the most effectual manner, which are those of keeping the trees perfectly clean and free from all sorts of rubbish, and the shade or annoyance of other sorts of plants, especially during their early growth, and at the same time having them well sheltered and secured from the intrusion of all sorts of live stock. It is only by attention in these different respects that plantations of any kind of trees can be raised with any degree of certainty or success.

The particular kinds of soil best adapted to the cultivation of the different sorts of timber-trees, and in which some or other of them will be found to grow in the most perfect manner, are gravelly or light sandy soils, with free porous sub-soils; gravelly or sandy



loams on porous sub-soils; loamy, sandy, or gravelly soils on retentive sub-soils; gravelly chalk or chalky loams on porous sub-soils: loamy clays or clayey loams on porous sub-soils: and strong clayey or loamy soils on retentive sub-soils. Likewise thin moorish heathy soils on gravelly or porous sub-soils, also on clay or retentive sub-soils. Such soils as are of a ferruginous kind, and of little depth, are found the most unfavourable to the growth of timber, especially where the sub-soil is retentive, as the destructive moisture in such cases stagnates near the surface, and deprives the roots of those healthy materials which they should take up for the purpose of nourishment and support.

In forming plantations, beside the necessity of having them properly secured by good fences, if the soils be not sufficiently dry, recourse must likewise be had to draining, to take off the superfluous water: the situation and soil being thus attentively considered and prepared, a proper selection of plants should be made. Such as most particularly deserve attention for waste lands, are oak, ash, elm, beech, birch, sycamore, larch, and the various kinds of fir. The oak has been found to thrive on soils of very opposite qualities, but those of a dry, deep, firm nature, are best adapted to it, with a proper degree of shelter. The ash prospers in almost every dry soil, even in exposed situations; in rather damp and free mellow soils the elm is to be preferred, especially for waste lands; if in very elevated places a chalky, gravelly, or light loamy soil abound, the beech may be planted with success. In all soils and situations the larch is found to thrive where the Scotch fir cannot be raised, and the latter is proverbially known to succeed in the poorest and most elevated places.

In planting, where it is performed on the more elevated or mountainous tracts, warmth and shelter are to be considered, as without these the trees seldom thrive in a perfect manner. In such situations there is, in general, the most difficulty, and the least progress made in the raising of timber trees; the success of the planter depending greatly upon fixing on such sorts of timber trees as may in future become the most highly valuable, on planting thickly with plants of not too large a size, and on a considerable plat or extent of ground both in length and width being planted.

In these unfriendly situations to the growth of trees, small plants must consequently be chosen and planted thick on the ground; as the winds are very prejudicial to trees of a large stature, by loosening the roots and frequently breaking the fibres; but though this is the most disadvantageous situation for planting, it is possible, with proper care in the above respects, to rear young timber in it. Where it is intended to cover a mountain from its base, it will be most conveniently done by planting round the base in the first instance, rising gradually; by which means an artificial shelter will be forming, from the progress that will be made by the trees that were first planted, especially if the extent is such as to require several seasons to complete the planting. The portion first planted should be pretty extensive, in all such cases especially where shelter is principally intended.



The kinds of trees to be chosen for such situations must be regulated, in a great measure, by the soil. The pine would perhaps be found to flourish most, but the larch is preferable as a nurse. The mountain-ash, the beech, the ash, the sycamore, the birch, the fir, &c. may all be planted with reasonable hope of success; and where the soil is deepest and richest, the oak.

In low sheltered situations, where the inconvenience of exposure to the winds is obviated, timber-trees may be planted with greater certainty of success; the chief care necessary in this case being to fix on trees of a proper kind, and placing them at proper distances, according to their sorts and sizes. As these situations admit of most kinds, on the more sheltered parts, the oak, larch, elm, beech, horse-chesnut, walnut, lime, spruce and silver fir, may be suitable; and on the less sheltered portions, the ash, birch, sycamore, hornbeam, mountain-ash, and fir, with a mixture of larch.

The banks of rivers and canals are mostly favourable for the planter's purpose, and most sorts of timber and other woods may be raised in such situations; the oak, elm, poplar, willow, and osier, according as they are more or less dry; but the preference must depend on the local circumstances of the different cases.

Situations near the sea-coast, or what are called maritime situations, are in general inimical to the growth of timber, but where such are attempted to be planted, the beech and sycamore will be found to bear the sea breeze better than most others, and consequently become desirable as nurses for the other trees. In these situations, where the bank rises high, the best mode may be to plant in the face of it, considerably within the level of the top, in order to afford a screen for the trees within till they rise to a sufficient height; and where it is flat, to adopt the method of planting in belts, beginning as close as possible to the edge of the water, and planting the first rows very close, as about thirty inches distance, employing stout well-rooted plants of not more than twelve or eighteen inches growth.

There are two different methods principally pursued by planters in providing the trees; one is by raising the plants in a detached piece of ground, as a nursery, from the seed; the other by purchasing the trees from the nurseries in the neighbourhood in the states proper for being planted out. The former is probably the best and most economical plan, where the business of planting is to be conducted upon an extensive scale, as it is mostly troublesome, and often impossible, to procure the quantity or sorts of plants that are wanted at the proper season. Besides, the plants in general succeed better when they are put in as fast as they are removed. But for small concerns it is, in most cases, more advantageous and convenient to obtain them from a nursery, as they can never be raised upon a small scale so cheaply as they may be provided in this way. Wherever nurseries are attempted, the nature of the land should be tolerably good, as it is almost impossible to raise good plants on very poor soils. Different sorts of land have been recommended for this purpose; but it is evident that no one kind can be fitted to the growth of every sort of tree; yet such as are dry and



friable, without being too light, are capable of raising healthy trees of most kinds. A late writer has recommended for this purpose “a loam of middling texture, rather inclining to sand, neither rich nor poor, from eighteen to twenty-four inches in depth; lying on a free, porous substratum. This will be found more generally congenial to the nature of the different forest-trees than any other soil. But there is no general rule without exception. If there be a diversity of soils, and if they do not too nearly approach the extremes of meagre sterility and excessive fertility, so much the better, since all the kinds do not exactly thrive alike in the same soil; and an opportunity would thereby be afforded of placing each in that more congenial to its nature. The site should neither be high nor low, sheltered nor exposed, in any extreme, for the same reason, viz. that it may the more generally answer all purposes. For a nursery of this description, nothing can be more eligible than the spot which may occasionally be occupied as a kitchen-garden. The pulverization and mellowness afforded by the previous growth of various culinary crops, bring the land into the most suitable state for the raising of young trees, and at the same time clear it the most effectually from vermin, as the grub, and other insects.”

The ground should constantly be well dug or trenched over to its full depth; and, when necessary, well dressed with composts of lime, marl, dung, or other similar substances; but other sorts of manure should always be applied with the previous crops, and not those of the tree kind. The method of cropping must depend on the nature of the land, and circumstances.

After the plants have been kept in the seminary for about two years, in most of the sorts, they should be removed to this nursery, and planted in rows or lines about twelve or more inches apart, according to their sort, and from three to five in the rows, where they may remain for two years longer, and then be finally planted out.

The next thing to be attended to, where the ground has been properly drained, is that of preparing the land for the reception of the plants. It is performed by the plough or the spade, according to the different circumstances of the land. When coarse plants prevail, such as heath, furze, broom, &c. they must be fully destroyed by stubbing, burning, or otherwise clearing away. When burning is practised the ashes should be blended with the soil, as they are found of great service in promoting the growth of the plants.

The mode of preparation by the plough on tillable sites, and where the soil is thin, is the cheapest and most effectual of any. Where the land has been in tillage it wants nothing more than two furrows, and an equal number of harrowings, to render it fit for the reception of the trees. But where it is in lay, a crop of oats, &c. should be taken the season before planting; or, if it is stubborn, a second crop, perhaps of beans, turnips, or potatoes, will be necessary; previously ploughing and harrowing well, and laying the land up in a perfect method. A trench-plough is frequently used for this purpose, which stirs the ground to the depth of twelve or fifteen inches. In this method it is essential to plough to the full depth each time.



When the spade is employed, which must be the case in steep situations where the plough cannot come, and where there are rocks, stones, or other obstructions; in this method the best planters advise that the holes or pits should be made to the full depth of the soil, and sufficiently large according to the size of the trees. For those of eighteen or twenty inches in height, whose roots occupy about nine inches when spread out, holes of fifteen inches in diameter may be sufficient. This must, however, be regulated by the judgment of the planter. As it is of great advantage to the trees that the turfy matter should be well broken down and reduced before the time of planting, it may be useful to have holes made a proper length of time before the trees are put in, to admit of this being fully effected, especially on the drier and more light soils.

From the desire of early appearance, it has been too much the case to plant forest-trees of too great growth. It is obvious, however, that there will be not only much saving of expense, but a greater certainty of success, in planting small young trees than such as are large and of greater age. Such as have been in the nursery too, three, or four years, according to their kind, may in common be the most advantageous as timber-trees. Mr. Nichol observes, that “deciduous trees of all kinds, except the larch, of from three to five feet in height, being carefully raised with good roots, will generally succeed.” He has, however, shown, that a one year’s seedling larch, nursed one or at most two years, will outdo all others of its kind in any soil or situation, and therefore advises planting trees of this age only. Firs of any kind will succeed better if under than above thirty inches, even in the most favourable soil and situation. Most generally those of fifteen or eighteen inches in height are to be preferred. From this view of the subject, it may occur to some, that to plant seedlings would be the most advisable and least expensive method. That it would be the least expensive method is obvious; but that it is most advisable, except for the Scotch and spruce firs, may, he thinks, be disputed.

“As the chief property of any young tree, intended for transplantation, consists in a multiplicity of healthy fibres, hence the necessity of nursing, *in kindly soil*, for a year or two, all *tap-rooted* plants, for the attainment of this object, and that we may commit them to the less genial soil and more untoward situation with greater probability of success. For, whether shall we suppose the plant which has both root and branch to make, or that which has the latter only, in the first season after so important a change of habit, is likely to succeed?—The latter, certainly. From which alone may be demonstrated the cause why plants of this description surpass those of greater size, as above stated. These are raised with unbroken, tufty, and fibrous roots; those with maimed, lank, fibreless ones; nor do they, with the utmost skill and attention, bear such proportion to the top. Consequently, the fibrils cannot afterwards, by the utmost efforts of human art, be induced so immediately to seek pasturage for the sustenance of the trunk.” For though lopping may in a great measure obviate this, injury is thereby done to the tree. In all soils and situations it is the safest



and least expensive method to plant young healthy well-rooted plants.

The circumstances to be next considered in this business are those of the distance and manner of planting: on these points Mr. Nicol's directions are, that "for the most exposed, bleak sites, and barren soil, from thirty to forty inches may be considered as a good medium; varying the distance according to circumstances. For in an extensive tract it will hardly happen that there is not a variety of soils. Some parts may be deeper and more loamy; others more gravelly or rocky. In the former, the greater distance may be advisable; in the latter, the lesser.

"For less exposed sites, and where soil is found above six inches in depth, from four to five feet will be a good medium; varying the distance according to circumstances, as above.

"For belts, stripes, or clumps, whose breadth or diameter does not exceed an hundred feet, lying in a bleak situation, and of thin soil, the margin on all sides should be planted at not more than two feet apart; the interior parts at three. Those lying on a more sheltered situation, and of deeper soil, may be allowed distance according to circumstances. But narrow stripes, or small clumps, even if the soil may be termed *good*, should generally be planted *thicker* than a more extended mass, that the plants may afford each other shelter.

"For the most sheltered sites, where the soil is deep, good, and where apparently every plant will grow, six feet will be a good medium distance. Wider than this, he cannot approve in any case, whatever; because at this distance, the plants have room to grow till their thinnings become useful. But, even were this not an object, there is a greater; namely, that the plants may not grow too squat in their infancy, and that the "pruning hook" be not much wanted in the formation of stately timber."

It is conceived that "he who plants too thin, with the idea of saving trouble in thinning, deviates as widely from the right path, as he who thins none at all." It is therefore contended, "that thick rather than thin planting is the safer side to err on. By which mode, also, there is a more equal crop on the ground, beeting or filling up vacancies being much less necessary."

Contrary to the common practice, it is supposed that thick planting is most necessary where the plants are largest, as the greatest number die in these cases.

In the Duke of Portland's plantations, where trees of various sizes are planted in an irregular manner, the number upon an acre is usually about two thousand. In respect to the manner of setting the trees in the plantations, it is probably the best method, except where vegetable crops are to be cultivated between, to plant without any regular order, though the line or row manner is frequently practised, as being the least troublesome and expensive.

There is another point to be regarded in the planting of timber-trees, which is, that of the most advantageous manner of intermixing the trees. Some have advised the planting in groups, to prevent the supposed injury of trees of different sorts growing together:



others, however, prefer the mixed method, not only as affording a better means of ascertaining what sorts of timber-trees succeed best, but as enabling the planter to protect them more effectually. It has been suggested that “it matters little whether we plant in distinct groups, or in indiscriminate mixture; provided in the latter case, we ultimately retain the most profitable and flourishing kinds only. For, with the proviso that most of the kinds evidently adapted to the soil and situation be planted according to the mode of thick planting, a sufficiency of them will remain, after all others are thinned away, for a full and final crop. For instance, if it should be supposed that the soil is best adapted to the oak, that it is desirable to raise the most valuable kinds rather than the decorative; and that exclusive of the larch for nurses, and a few firs to enliven the borders, six kinds are to compose the mixture; plant two oaks for one elm, two elms for one beech, two beeches for one ash, two ashes for one birch, and two birches for one sycamore. And thus will the plantation at once be formed, in uniform gradation, of kinds most likely to succeed each other, in the case of either disagreeing with the soil or climate; and which also succeed each other in respect of value as timber: doing justice at least, to the patriotic intention of the planter, should the first and more valuable kinds fail.”

It is of the utmost importance, as has been already seen, in raising plantations of the timber kind, especially in bleak exposed situations, that warmth and protection be afforded by the judicious use of trees of quick erect growth and numerous branches. It has been observed, that in all situations, and on all soils, except those termed humid, and which are adapted to the aquatic kinds only, the larch is without doubt the most proper nurse, and therefore should take preference of all others for this purpose. But that on sub-humid, or loamy soils, the Lombardy poplar and Huntingdon willow are good substitutes; and, when variety is the object, ought to be mixed with the larch, for the purpose of nursing the other more valuable kinds. And that on elevated, poor sites, the mountain-ash, for the first ten or fifteen years, is outdone by the larch only, in the office of nursing, and is justly admitted for the sake of variety. In all situations this plant grows quickly in youth. In maritime situations, the sycamore is likewise eminently useful for this purpose. “Few trees, except the above, grow fast in youth, and none are more patient of the sea-breeze. Consequently, when the site is much exposed thereto, this tree should be freely planted in mixture with the larch for nursing the oak, beech, elm, &c. if the intention be the culture of ship-timber.” The common pine may sometimes be useful in this view, and afford greater variety. The proportion in which trees of this sort should be employed must obviously depend on the peculiarity of the situation, and other circumstances. Some recommend in thin soils, and bleak situations, tree for tree; and in less exposed situations, and better soils, one nurse for two principal trees: and in most sheltered situations, with good soil, one nurse for three, four, or five principal trees may be a sufficient allowance.



On the most exposed and bleak situations, where the soil is evidently sterile, the safest way is to plant too many rather than too few.

We come now to the business of planting out the trees. The season for performing this to the most advantage, and with the greatest chance of success, must differ according to the nature of the soils and the plants, as well as the state of the weather. In the more porous dry soils, with the hardier sorts of trees, the autumn, as from the middle of October to the latter end of November, may be the most suitable; as they will be better established against the summer heats, which are often destructive to new-planted trees. But in the more heavy and moist soils, especially those of the clayey and loamy kinds, and with the less hardy sorts of trees, the early spring season, as from the middle or latter end of February to the beginning of April, may be the most proper. The condition of the land should be particularly attended to in this business, as it is equally improper to plant when either in too dry or too moist a situation. It has been well remarked, that “at a time when the soil is neither wet nor dry, the operation of planting is most easily, and also most successfully, performed. The mould adheres not to the spade, nor does it *run in*; it divides well, and with little trouble intermingles with the fibres; nor, in the operation of treading and setting the plant upright, it is wrought into a mortar, to the evident prejudice of the plant, whatever weather may ensue: consequently, on a retentive soil, it cannot be proper to plant in time of rain, nor in many cases for a day or two afterwards; nor after a fall of snow, until for several days it has entirely disappeared. Whereas, on a dry absorbent soil, it may be very proper to plant in time of gentle rains, immediately after heavy ones,” or on the snow disappearing.

The differences in the forwardness of the vegetation of different sorts of trees should also regulate in some measure the time of planting, where those of the same sorts are only made use of. In this view, it is advised that the larch, elm, sycamore, lime, horse-chesnut, mountain-ash, birch, alder, poplar, willow, &c. should be put in by the beginning of March: and that the oak, birch, ash, chesnut, hornbeam, &c. be finished planting by the beginning of April at the latest. The best season for the planting of many trees of the evergreen kind, such as the Weymouth-pine, spruce, Scotch, silver, and other firs, is supposed by some to be in the latter end of July, or in the following month, when the weather is moist or cloudy.

After the trees have been taken up with care, so as to injure the fibres of the roots as little as possible, and a few of the bruised extremities cut off, they should, when intended to be planted in mixture, be put together in proper proportions, and conveyed in this way to the place where they are intended to be planted. They must then be distributed on the ground, at the pits or other place, in order to be ready for the planters, as by this means much time is saved, which would otherwise be lost in sorting. But to prevent the roots from getting too dry, it is necessary not to take up, or bring on to the land, more than can be planted in a short space of time. This should invariably be the practice. Where only one or two sorts



of trees are, however, to be planted, the usual practice of carrying the plants along as the planting proceeds may be the most convenient method.

The operation of planting is the best and most expeditiously performed by two persons; a man to do the work, and a boy to hold the plants. In performing the business, the labourer first stirs the mould well in the holes or pits that have been previously prepared, rendering it level, and fit for the reception of the plant; or forms new holes according to the mode of planting. The boy then places the plant in the hole with all the fibres of its roots regularly spread out and unconfined to the depth of about an inch more than it had stood in the nursery, holding it perfectly upright; while the man gently fills in the loose mould, moving the tree a little up and down to let it mix with the roots: the remainder of the earth is afterwards put in; and then the labourer proceeds to the preparation of the next hole, leaving the boy to set the plant erect and close the mould about it, which in soils of the stiffer sort should be only performed in a light manner, but in those of the drier kinds, as the sandy and gravelly, as close as possible. In this way the work is to proceed till the whole is finished. There are other methods of planting, as by forming slits, nicks, or openings of other kinds, so as just to squeeze in the roots of the plants: but these never succeed well.

Much of the success of the planter depends upon having this part of the work well executed; but great care should be taken, particularly where the land is inclined to moisture, or of a retentive quality, not to plant at too great a depth. In planting on steeps, it is directed that the trees should be placed towards the declivity, being planted at the lowest part of the opening; which should, in completing the business, be left the highest, by which the moisture may be better preserved.

It seems not improbable but that in many cases and situations the planting of small trees of the timber kind might be performed with great convenience and expedition by the assistance of a plough suitable for the purpose, as has been sometimes practised in setting hedge-plants.

In the planting of trees of considerable growth great attention is necessary to have them well secured against the wind, as, when they become loose, the fibres are so broken and destroyed that they soon die. This has been commonly effected by means of staking: but as in this way the trees are often in danger of being injured by rubbing, a practice of ramming the earth closely about the roots has been attempted, which in some soils, and upon small scales of planting, has, it is said, been found to succeed; but in extensive concerns it is wholly inadmissible, from the trouble that must attend it.

When the plants have all been put in, it is a practice with some to sow or set the plantations with acorns, as it is found that sown oaks, as well as other trees, exceed in growth those that are planted. This work is done either by paring off the surface with a mattock, and setting the acorns with a dibble, or by putting them in short drills by the



hoe at the distance of about six inches. The best season for performing this business is in April, and it may be effected the first, second, or third year after planting; but the first or second is probably to be preferred. Great care should be taken to preserve the acorns well, by exposure to the air, and frequent turning for this purpose, as they are very apt to sprout soon after being gathered.

After the trees have been planted, it is necessary not to lose sight of the plantation. The young plants must be kept clean, and free from the annoyance and choking of coarse weeds of all kinds, for at least three or four years. This may be effected by the hoe in many cases; but some have recourse to the culture of different sorts of crops in this view. In this method, however, much care is requisite not only to avoid injuring the plants, but to guard against the soil being too much impoverished and their growth thereby much restricted.

When coarse plants abound, such as broom, furze, briers, and other similar productions, in all the less exposed situations, they should be wholly cut up and destroyed; but in bleak exposures it may be a better practice to only clear them to a distance round the trees, so as that they cannot do any injury by rubbing or striking against them; the other parts being left for the purpose of sheltering and protecting the young trees.

There is another point not less requisite to be attended to in young plantations, which is that of filling up the vacancies that are caused by the dead plants. Where the ground is kept perfectly clean, this may be done at any proper season; but in other cases, when the dead plants cannot be so easily detected, it may be better to delay the business to the third or fourth year, when the deficiencies can be more perfectly ascertained. If this sort of business be done too early, many plants are frequently removed that would have thrown out from the bottom, on account of their not being dead in that part, though wholly gone in the top.

The plants employed in filling up the plantations should never be too large, as, where that is the case, they are more liable to die.

There is another kind of planting which is frequently practised, but the propriety of which still remains a desideratum. This is that of setting the hedge-rows with trees of the timber kinds. Some contend for the utility of the practice, on the grounds of the degree of shelter and ornament that is afforded, as well as its being a means of raising much useful timber at little or no expense; while others condemn it as highly improper and disadvantageous, on the principle that much injury is not only done to the crops, especially when of the grain kind, both by the dropping and the spreading of the roots, but also to the hedge, in the places where they stand, by their producing gaps and openings. But though some inconvenience and injury may be sustained where this sort of planting is much in use in arable districts; yet from these being in a great measure capable of being obviated by proper training and pruning, and from the naked appearance which is exhibited without them in a country, but more particularly from the vast benefit that may be derived in the way of timber, it would seem that some extent of planting in this method



should be attempted in most situations. But in performing the business, the nature of the land, the sort of husbandry that it is principally conducted under, and the kind of exposure in which it is placed, should be well considered, and the sort of trees properly adapted to it. The trees where the ground is mostly in an arable state should be planted at much greater distances than under the contrary circumstances, and such trees as run most to tall clear stems be preferred. The trees for this sort of planting should be larger than in other cases, being kept in the nursery two years longer than has been advised above, and shifted so as to produce more fibrous roots. When about five or six feet in height they are probably in the most suitable condition for being removed into these situations.

The most proper time of planting in hedge-rows is when the fields are first broken up from the state of lay. Where the planting is performed in the hedge-rows of grass lands, the trees must always be perfectly secured from the croppings of cattle, as well as the rubbing of sheep, or other animals, as, where this is not the case, they are soon destroyed.

The planting in these cases should always be carefully performed in the manner that has been already described; and where the trees do not stand perfectly firm against the wind, they should be well secured by stakes, or other proper means, as they never thrive well when not perfectly fast.

The barbarous practice, too frequently made use of in different districts, of converting the hedge-row timber-trees into pollards by lopping off their top branches, should in all cases be guarded against as much as possible, as it is the destruction of timber. Where pollards abound, they are mostly cropped once in from about nine to fifteen years, the profit of which mostly belongs to the tenant. This work should be constantly finished by the end of February.

In plantations of timber and other sorts of wood, it is necessary to attend to the proper pruning and thinning of the trees occasionally as they advance in their growth, in order to prevent their growing in an improper manner, and their injuring each other by rubbing, or being drawn up weak. In the first view they are therefore to be occasionally looked over after the third season from planting, and such headed down, or otherwise cut, as may appear necessary for their more perfect growth. When this has been done, the only thing further will be to encourage a leader, by shortening all the other branches that appear to contend with it to nearly one-third of their length, in order to strengthen the main stem. The whole that is afterwards necessary is that of properly thinning the strong top branches, and those on the sides, which may be done by a light bill. This is applicable to trees of the forest kind; but those of the fir and evergreen sort require nothing more than the regulation of their leaders, as that of keeping them single where they throw out double. The less the side branches are touched the better.

The proper thinning of plantations or woods is a matter of the greatest consequence to the growth of the trees, as where they are too much crowded they are apt to be drawn up weak. In mixed plantations the nurse trees should be first gradually thinned out,



beginning with those of the most inferior kinds, few of which should be suffered to remain after ten or fifteen years. In performing this business much must be left to the judgment of the operator and the circumstances of the plantations; but the chief rule is to keep the extremities of all the side branches so as nearly to touch each other, and to have a due regard to the distance of the tops, not the roots of the trees, as some require much more room than others.

In the plantations in Nottinghamshire, about the fourth or fifth year after planting, the small-sized birch and seedling oaks are grown to a proper size for transplanting. In the thinning of these, care is had not to take too many away in one season; as, by being properly managed, a supply of plants for at least half a dozen years is provided. About the same time that the smaller sized birch wants thinning, the large ones require to have their lower branches taken off, so as to keep them from injuring the oaks: and this is the first profit of the plantations, the birch-wood being readily bought up by the broom-makers. This pruning is continued as often as required, till the birches are grown to a sufficient size to make rails for fencing; they are then cut down, to make room for better trees. By this time the oaks are grown to the height of twelve or fourteen feet, when they draw themselves up exceedingly fast. After the birches are cut down, there is nothing more to do but thinning the oaks from time to time as requisite, and cutting off their dead branches as frequently as may be necessary. In performing the first much caution is required; for, if length of timber can but once be obtained, time will bring it into thickness: they are therefore let grow very close together for the first fifty years. In respect to the progress of the oak in two plantations, one of twenty-eight, the other of fifty years growth: in the former, the trees were in general about twenty-five or twenty-six feet in height, and in girth about eighteen inches; but in the latter something more than sixty feet in height, and in girth a little above three feet, being in general about fifty feet in the bole. Plantations of the fir kind require less thinning than those of other trees.

The thinning of underwoods must be regulated, in a great measure, by the luxuriance of their growth, and the purposes to which the cuttings are to be applied; when for the larger uses more thinning will be necessary than in the contrary case.

There is another sort of planting which, in many situations, such as those of the moist boggy sort on the borders of rivers, is extremely advantageous; this is that of the willow or osier, for the purpose of the basket-makers. The method of planting in these cases, on the banks of the Thames, is thus described in the *Transactions of the Society for the Encouragement of Arts, &c.*

“The ground is dug during the winter a full spade’s depth, and left rough, to prevent the tides from running it together again before it can be planted.

“The work begins in the month of March. The planter having procured the sets or plants, which are fifteen or sixteen inches long, cut diagonally off the strongest shoots of the last year’s growth, care being taken that they are not cut near to the top of the roots,



that part being too porous to make a sound plant, the ground is then marked out into rows two feet asunder; and the sets are stuck in the rows eighteen inches from each other, leaving about seven inches of the sets above the ground. This work is very easily done, without using even a dibble or a setting-stick; but, when planted, care must be taken, by hoeing, to keep them as free from weeds as possible; or, if the ground be too wet for the hoe, a weeding-hook may be used to keep them down: this is absolutely necessary to ensure a good plantation. It is also equally necessary to keep the ground well drained, to prevent the tides remaining upon it any considerable time, for on that also depends the firmness and good quality of the rods.

“The willows are cut over the first year with a bill-hook; the shoots are cut off close to the stock, and bound up in bundles, or *boults*, as they are called, which measure forty-two inches round, at sixteen inches above the butt ends. The same process of weeding must be pursued every summer, while they are shooting up from the stem. The next cutting season a portion of them is left to stand another year, where large stuff is wanted for the ribs of large baskets, &c.

“The planting of willows is expensive the first year; but if well managed they produce a great profit, as they improve in quantity every year\*.”

As the demands for this sort of produce are very great, wherever the farmer has lands that are suitable for this kind of culture they should not be neglected. On such moist boggy soils the cultivation of the Huntingdonshire willow has also been found extremely profitable when grown for the purpose of hop-poles.

*Management of Woods.*—It is always a convenience, and in many cases and situations a very profitable thing, to have woods for the

\* The names and uses of the species employed in the vicinity of Brentford are thus described:

“1st. The *salix vitallina*, or yellow willow, which is cultivated chiefly by the nursery-men, and being of a tough yielding nature, is used for binding packages of trees and shrubs in the drawing season, and for tying up the branches of wall and espalier trees.

“2d. The *salix amygdalina*, or almond-leaved willow, is a species of which there are several varieties, one of which is called by the planters “the small red willow,” or “binding rod;” it being chiefly used for binding the produce of garden-grounds. Another kind of this willow is at present known by the loose appellation of the “new kind;” it is of large growth, and produces a great crop, is used both by the basket-makers and the corn-sieve-makers, and is fit for any work which requires a firm as well as a tough rod.

“3d. The *salix viminalis*, or osier willow.—Of this species there are also several varieties, which are called among the planters by the name of “the yellow and brown osiers,” or Comb’s osiers.” They are chiefly used by the basket-makers, being very pleasant working rods, and as they produce a great crop are much cultivated.

“These three descriptions comprehend the most useful varieties, and are the most profitable in point of crop of any that are cultivated in this district. There is, however, a coarse sort of willow known by the name of “the Spaniard;” but whether it is a distinct species or not is not decided; it might be rendered extremely useful in counties where much brush or underwood is bound.”



purpose of cutting for the use of the farm, or with the view of sale; but in either intention it is absolutely necessary that they be kept in a good state of preservation from the destructive browsing or croppings of cattle, by proper fences, and well stocked with the most useful sorts of wood that are capable of being grown to advantage on the peculiar soil and situation, as, without due attention in these respects, from most of the stocks that afford the wood “being in fact only pollard trees growing under ground, it is obvious that the produce of such stocks must, like the shoots of pollard trees, be the most abundant when the parent stocks are in the greatest perfection; that until they attain that perfection it must be small; and that, when past that perfection, they gradually decline; the shoots from them become weaker and fewer every successive cutting, and the stocks finally decay and die. To prevent the decay of woods it is necessary of course from time to time, to renew them by raising new stocks to supply the place of those which gradually wear out or are destroyed. But besides the regular decay of age, to which all woods are liable, there are other injuries to which they are exposed, and which speedily and prematurely bring on their decay, unless prevented by proper means. One is the pernicious custom of suffering cattle to feed in woods, under an idea that, after they are of a certain age, as seven years, the shoots are grown out of the way, and cannot be hurt. In strong thriving woods, it is possible that cattle may do but little harm to the underwood, after it is seven or eight years old; but all the young plants, which either spring up spontaneously, or are planted in them, must be liable to be cropped and kept down, and few of them can come to perfection. And in weak, decaying woods, there is always a great deal of the underwood so low as never to get out of the reach of cattle, but constantly liable to be crompt and kept down by them, and the decay of the stocks consequently much hastened. Another cause of the early decay of woods, is the want of draining such parts of them as are subject to be moist and damp; nothing being so prejudicial to wood as too much wet. This begins to be well understood in most draining districts, and has been practised with success. A third cause of decay, is the custom of suffering woods to grow too old before cutting, whereby the strong shoots smother the weak ones, and, by their dropping, kill the stocks on which they grow. And to this may be added the practice of permitting the buyer to cut the wood, thereby making it his interest to destroy every sapling, and to cut the underwood as close to the stock as possible—which in old woods is highly prejudicial to the succeeding shoots—as well as the custom of not obliging the buyers to clear the woods early in the summer, so as to prevent the new shoots from being injured by their cattle, carriages, and other circumstances.”

In forming or improving woods of the coppice or underwood kinds, it is particularly necessary to pay attention to the nature of the soil as well as that of the aspect; and to adapt the trees and plants to the nature of these as much as possible, at the same time taking into the consideration the kinds that are most useful and most in request in the district or immediate vicinity, as from its



bulky nature it is in general the most profitable when disposed of without the trouble of much carriage. Various sorts of plants and trees, as has been seen above, may be employed in this way, according to the state of the soil; but it has been observed that “taking the general demand of countries, and the peculiarities of different soils, into consideration, there is no kind of wood so generally proper for planting in this way as ash. The value of ash-poles being at least one-third more, and frequently as much again per hundred, as that of other poles (being applicable at all sizes to some useful purpose or other); the timber being always in request, and saleable at any age or size, at almost the price of oak; and the wood itself being as quick a grower as any, and quicker than most: and, above all, there being but few soils, from the blackest and wettest bogs to the highest and most exposed mountains, where it will not grow, are reasons why ash is one of the most profitable woods to plant in such coppices as are favourable to its growth. But in soils and situations where ash does not grow kindly, let such other sorts of wood be planted as appear to thrive best in similar soils and situations in the same country. Spanish chesnut, though not so general a grower as ash, is a most excellent wood, either for timber or underwood, and wants only to be more known to be higher in estimation. It partakes much of the properties of oak, but excels it in two points, viz. that it grows faster, and that the sap part of the timber is firmer and less corruptible.”

If it be profitable to plant new woods, it is certainly much more so to protect those that are already planted, to fill them up where thin, and to restore them when in a state of decline. The expense in this way is not only lessened by the saving of new fences, but the profit is greatly increased by the rapid growth of the wood, when planted in situations that are sheltered by other trees and plants already planted. In woods where saplings rise in great numbers spontaneously their growth should be encouraged. As, at the time of cutting the underwood, such saplings may, perhaps, be fourteen or fifteen years old; it might appear proper, after leaving for timber-trees such as are straight and handsome, to cut off the rest for underwood; but a great part of the saplings at that age so cut off will not be large enough to produce shoots sufficiently strong to get up as fast as the other underwood. These shoots will therefore suffer, and the stocks never come to perfection. It is consequently, in general, more advisable not to cut off such saplings as are intended for underwood, until the second cutting of the wood, when they may be probably near thirty years old, and will then throw out shoots strong enough to fight their way, and keep pace with the surrounding underwood. But where saplings do not spring up in abundance in this way young trees must be planted, part of which may be preserved for timber, and the rest left to be stubbed off for underwood at a proper time.

For the purpose of filling up such woods as are “grown thin by age or neglect, the proper time is one year, or at the utmost two years, after the underwood is cut. The young plants should be eight or ten feet high, and an inch and a half in diameter at the ground,



and should be planted without cutting off. If the soil be dry, no other preparation is necessary than barely digging the holes for the plants. If wet, deep drains should be made to take off the superabundant water. The earth dug from these drains being thrown out on the lower side of them, upon this new earth the plants should be planted. If land on this latter description be black and peaty, ash is peculiarly proper for it, and will, if planted on the earth thrown from the drains, make a most surprising progress. If it be a stiff yellow clay, it is generally more favourable to the growth of oak than of ash. In such soils, oak for timber, with a mixture of willow, birch, alder, and Spanish chesnut for underwood, will perhaps be the most proper. All these kinds should stand one round of the underwood, and if still weak should stand two, before those are cut off which are intended for underwood. Birch plants however are an exception to this rule: they should always be cut off the first round of the underwood; for if they are large when cut off, the stocks frequently decay and die. In all mixtures of kinds of wood for coppices, those sorts should be used which are not unfriendly to each other, and which will come round fit to be cut together at the same periods; and such kinds should be allowed to stand for timber, and that at such distances as to injure the underwood as little as possible. The plants for filling up old decayed woods should be the strongest and best of their kinds; and those which are weak at first will be drawn up by the surrounding underwood, and become from their increased height still weaker. At the next cutting of the underwood they will be blown down: or, if cut off, the shoots will be too weak to grow up with the other underwood. Oak, ash, and Spanish chesnut should be kept in a nursery for this purpose; alder and birch plants grow plentifully spontaneously in some countries, and may be taken up for use. Alder is sometimes propagated by taking up old roots and dividing them into several parts; and hazel may be raised in the same way. Willow is generally planted in cuttings: but a much better way, where there are any old willow stocks, is to plash down the shoots to fill up the vacant places round such old stocks."

It is a question which has not yet been fully decided, and which can only be well ascertained by trials made upon a number of poles or stems of different sorts of woods at different growths, as seven, fourteen, and twenty-four years, to see whether the increase is in proportion to the length of growth. In this way, proper attention being paid to the nature of the soil by nice observation, in time a correct and useful estimate might be obtained of the most advantageous periods of cutting woods. The practice of cutting differs in different districts, from seven or eight to twenty-five or thirty years; but the most common is probably from twelve to fourteen or eighteen. There is also a practice in some wood countries of leaving one or two stems upon each stool for a double growth, by which a portion of large wood may be procured in each fall. In this way it is probable that there may not be a much less increase in the growth of the other parts of the wood, while the largeness of these stems may afford more profit, and admit of being applied



more generally, and to more important uses. If there are causes that cannot be obviated, so as to prevent cattle from injuring the early growth of woods, it must obviously be the most profitable method to defer the cutting to as late a period as possible, from the mischief being chiefly in the first few years. For many uses it is impossible to cut at the more early periods, except on very good soils indeed. This is the case with ash and oak, for hop-poles, and some other sorts. On the whole, it seems therefore probable, that the most profitable method may in general be to defer cutting till the later periods.

In the extensive woods of Buckinghamshire, where the produce is chiefly beech, it is the practice not to cut till from twenty-five to thirty, or even thirty-five years, by which means they consist almost wholly of successions of young trees. In the cutting, the trees of a proper age are annually singled out and cut, without having recourse to regular falls, as in other cases. The extent of the cuttings is made so as to pay the proprietors from about fifteen to twenty shillings the acre, in proportion to the goodness of the growth. The best afford a clear profit of twenty shillings under this management. In Worcestershire, where the woods are chiefly cut for the sake of the bark, they are felled at about forty years growth, a proper quantity of store woods of fourteen and twenty-eight years growth being left for the next fall. And in the neighbouring district of Hereford it is sometimes the case to fell at from eighteen to twenty years growth, and in others at from twelve to fourteen or fifteen. In the former it is chiefly oak; but in the latter case ash, sallies, and alder. The whole is cut, and such parts as are proper applied as hop-poles, with much profit. The twenty years falls are stored and applied in the usual manner. In cutting wood one *maden* standard is left to each *lugg* or forty-nine square yards. Coppice-wood will produce at from 2s. 6d. to 4s. 6d. a *lugg*, from twelve to twenty-two pounds the acre, at from twelve to fourteen years growth, which is a greater return than could be obtained in almost any other way in such soils and situations.

The Dillorn woods in Staffordshire “form a chain of three or four miles in length, and consist of tall, straight oaks and ash, which are in general so well filled up with underwood as to be cut in gradual falls at seven years growth, and produce, when well fenced, six pounds per acre, for rods and staves, used for crates in the neighbouring pottery. Eighty-four acres of wood will admit of twelve acres being cut annually, and will produce seventy-two pounds, which is about seventeen shillings per acre per annum for the underwood, exclusive of the timber; while the bleak neighbouring hills which remain unplanted are not supposed worth more than three shillings per acre.”

It has been suggested by Mr. Davis, that “the periods of cutting underwood should be regulated by the luxuriance of its growth, the demand of the country, and the uses to which the wood is to be applied when cut. In the article of underwood, not only the interest of money, but the loss of the succeeding growth, tell against the value of standing wood after it is fit to cut, and make it doubly the



advantage of the owner to cut his underwood as early as it is saleable. As soon, therefore, as any kind of wood is fit for the uses of the country, it should then be cut, unless it can be made appear that it will pay compound interest for standing longer, or, in other words, will pay not only the simple interest for the first value, but also the loss of so many years growth of the wood, as so far advanced towards another crop. Wood merely for fuel can scarcely be cut too young. Hazel is usually fit for hurdles and dead hedges, from nine to twelve years old; ash for sheep cribs, at the same age; and ash and other woods for hop-poles, from eleven to fourteen years old; while ash for carpenters and other large uses, alder, birch, and willows for rafters, turners' uses, pattens, clogs, and coal-pit uses, should stand from sixteen to twenty years before the poles are large enough for their respective purposes."

The business of cutting wood usually commences in November, and may be carried on through the winter months till February or March; but should be completed before the beginning of April, except where the wood is to be barked; in which case the beginning of May may be the most proper, as it will then generally *run* the best.

Opinions have differed much, Mr. Davis observes, "respecting the most proper time of the year for cutting underwood; but there is one rule which, on the seller's part, is without exception, viz. that the older the wood is the later in the spring it should be cut. When old wood is cut early in the winter, and a hard winter follows, the damage done to the stocks is very great; young flourishing wood will bear cutting at any proper season. But on the part of the buyer it is allowed that all woods are more durable when cut in the most stagnant state of the sap; and in all cases where bending is required, such as hurdles, hoops, and even dead hedges, the wood cannot be cut too early in the winter, being, if cut when the sap is rising, brittle, and unfit for those purposes." Oak underwood, as bark sells at present, may pay well for standing till the sap is up for barking, and the stocks will seldom be much hurt by the practice.

The work of cutting wood is mostly performed by measure, or what is sometimes termed tale. The wood is differently managed in different districts; in some it is merely cut and laid in rows or drifts, being disposed of in that state by the rood or other measure. In other cases it is regulated according to its uses, being sorted by the farmer into hop-poles, hoop stuff, hurdles, faggots, stakes, and edders, &c. which is probably the most advantageous practice; but the farmer should be cautious in listening to the advice of workmen on these occasions, as they mostly suggest that method which will be the most beneficial to themselves.

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# THE FARMER'S COMPANION.

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## PART THE FIFTH.

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### METHODS OF BREEDING, REARING, AND MANAGING DOMESTIC ANIMALS.

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#### SECTION XXIII.

*Live Stock.—Neat Cattle.—Sheep.—Horses.*

WHATEVER superiority of attention may formerly have been bestowed upon other branches of husbandry, there is scarcely any that is of more importance to the farmer, or which of late has undergone more improvement, than that of Live Stock. It was indeed to be expected, that in proportion as the means of its support became better understood and more abundantly cultivated, useful changes and improvements would take place in the nature, quality, and breeds of the different animals that were to be kept, and of course a double advantage be obtained by the farmer in the improvement of his land as well as stock. There is another circumstance that has also had considerable influence in promoting the increase and improvement of live stock, which is that of the vastly increased demand for the animals, either in consequence of their great usefulness in performing different sorts of labour, or for the purpose of human food.

But though much has been effected in different situations in bringing different kinds of live stock to a higher state of perfection, much still remains to be accomplished. It is probably, in general, far from having attained that state to which it is capable of being carried, by those farmers who have the knowledge of combining the best and most appropriate breeds of cattle and other animals, with their improvements in the cultivation of herbage, or the raising of other sorts of green food for their support. But to enter fully into the nature and explanation of the best and most certain modes of effecting such improvements in all sorts of live stock, a much larger collec-



tion of facts would seem to be necessary than has yet been made, as well as a vast number of additional experiments. In the present state of our knowledge on the subject, it is perhaps only possible to afford a few hints and directions that may be useful in guiding the attention of the farmer.

It has been well remarked, that whenever it is meant to attempt any considerable improvement in the nature of the live stock of a farm, care should be previously taken that there is a sufficient degree of shelter, shade, and warmth, as well as a high degree of fertility of the land, and a suitable state of drainage, as it is only by the richness and abundance of food that such changes can be effected in the most advantageous way, or the stock be brought to any high degree of perfection.

In the business of improving different kinds of live stock two different systems have been chiefly pursued. The first, or that which has prevailed for the greatest length of time, is by means of crossing the various breeds, so as to supply the faults or defects of the one by the merits or perfections of the other; the latter, or that which has been more recently introduced and brought to the attention of the farmer, is by uniting the perfections of the same kind, by continuing to breed from the best and most perfect animals in the same line, family, or blood.

On this involved but interesting subject various useful observations drawn from the structure and physiology of the animals, have been lately offered to the breeder and grazier by Mr. Cline, in a late volume of Communications to the Board of Agriculture.

It was supposed for a great length of time, and is still by some, that the former of the above methods, besides its superiority in other respects, possessed considerable advantages in preventing the animals from becoming small, tender, and liable to disease, in consequence of their being too near a-kin. This notion has, however, been shown to have little or no foundation in truth, by the great success which has attended the contrary method, in the practice of one of the most intelligent and expert breeders that this or perhaps any other country has produced; as his best stock has been raised by the nearest affinities, not only without either diminishing in size, becoming less hardy, or being more subject to disease; but on the contrary with a continued amelioration and improvement. And a still more conclusive proof is, perhaps, afforded in such breeds of cattle as have remained for many centuries in the state of nature, in particular situations, without any mixture of others; as in such cases, though from their unrestrained condition, they must, without doubt, have bred in all the different possible degrees of affinity, they have been found to continue without any diminution either in their size, hardiness, or health, and without undergoing any injurious alteration in their form, or change in their colour, or other peculiarities. But in opposition to these strong proofs, it is still contended by others, though confessedly without any very great experience, that in this method “young stock decrease rapidly in size on the same pasture,” without any “other ill or good effect taking place in consequence of it.” It is likewise further observed, in



contradiction of the same opinion, that in proportion as an animal decreases in size, it may be reasonably supposed to decrease in vigour and activity, but that, how far this may render it capable of feeding or living on less food is not ascertained. There is no doubt; however, it is said, but that very beautiful animals may be produced by breeding *in and in*, as “the young animal comes into the world on a small scale; but by keeping it fat from the first moment of its existence it is made to attain a greater size than nature intended, and its weight will in consequence be very great in proportion to the size of its bones. But this is far, it is supposed, from proving that the practice is eligible.” And it is still further contended in regard to cattle, that as in this system of breeding no expense is spared in feeding the young stock, the breed should of course have attained a larger size: yet they are not only less, but, it is asserted, “carry less fat on their best joints than the Herefordshire cattle,” which from the first year are kept in a much inferior manner.

The effects of the same method in the dog have been found in some degree similar; “the breed has become less in size, but not less keen or active, and by crossing again with a breed of no larger size, it has attained its former weight. It is likewise added, that some experiments of crossing the breeds or kinds of plants have thoroughly convinced the writer, “that in the vegetable as well as the animal world the offspring of a male and female not related, will possess more strength and vigour than when they were both of one family.” It is not however supposed “that crossing similar breeds of cattle has ever a good effect: as the breeds mix without assimilating. When the long-horned breed of cattle has been crossed with the Herefordshire, some of the offspring have followed one breed and some the other, and some presented an awkward mixture of both.

In this state of the facts, no certain conclusions can therefore be drawn. The safest plan is, probably, to have recourse to both methods, according to the nature of the improvement that may be required; and as there is no possible means yet discovered of rendering accidental varieties in either the animal or vegetable kingdom permanent, the best way is constantly to breed from the best and most perfect animals of their kind.

It is indeed obvious, that in the crossing method of breeding, though it must be allowed to be extremely useful in many respects, the greatest care and circumspection should be employed to adapt the animals in the most perfect manner to the nature of the improvement which is required; otherwise the breed may be in danger of sustaining injury instead of advantage. From the vague and random manner, indeed, in which attempts to improve the breeds of live stock on this principle have in general been conducted, it would seem not improbable but that disadvantage may often have been produced by bringing together such breeds, as from the great differences in their forms, qualities, and other properties, could have little or no chance of effecting the purpose of improvement in any useful manner. The agricultural surveys of most of those districts where breeding or grazing has been carried to any extent,



almost uniformly complain, that useful breeds of live stock have been injured and debased by the practice of crossing injudiciously conducted. And a late writer, in speaking of sheep, has well observed, “that to the mountebank doctrines of crossing dissimilar breeds, which nature in its infinite wisdom had set asunder, we are indebted for much confusion and mismanagement.” But it must notwithstanding be allowed, that by crossing, when conducted with sufficient judgment, improvement may be effected, especially in what relates to bone or size, the hide or coat, the bettering of particular points or parts, and perhaps in what regards the movement or speed of the animal: but in other views it would seem incapable of producing those beneficial effects which should constantly direct the steps of the breeder.

As it is in some measure a principle founded in physiological science, and countenanced by the observation and experience of ages, that animals are somewhat endowed with the faculty of not only propagating an offspring that has in a considerable degree the properties, dispositions, and resemblance of themselves, but that is in some measure subject to a similarity of disease; it would appear that although there may be occasional deviations, the most certain method, and that which has the best foundation in the nature and economy of the animals, (in so far as the particular qualities and other properties, besides those that have been just mentioned, are concerned,) is to breed in the same *line*, perhaps in the same family; as, by a careful procedure in this way, the expert breeder may not only have the greatest security for attaining that improvement which he is anxious to produce, but run the least risk of deterioration.

The success of the practice has indeed not merely been shown in the breeding of the farmer's stock, but in that of the sportsman. It has been found that pointers and game cocks have been bred with the greatest perfection and superiority in this mode, which in the technical language of the breeder is termed breeding *in-and-in*. And it is by the same means that the valuable properties of the race-horse are perpetuated and preserved. The same thing likewise takes place in the vegetable economy, the finest and most perfect productions of the sort being propagated by sowing seed selected from the best and most perfect plants of the same kind, and taking the buds or offsets from the best and most perfect trees of the same species.

There is also another circumstance that seems to show the propriety and superior advantage of this method of proceeding in the breeding of domestic animals; which is, that however much the breeds of live stock may be altered by climate, pasture, and other causes, in what respects their colour, and other trifling particulars, their specific characters remain invariably the same. No causes of these kinds have ever been capable of changing any one of the distinct breeds, whether of neat cattle, sheep, horses, or hogs, in such a manner as to have the characteristic distinctions of those of any of the others. It would therefore appear that by having recourse to occasional crossing in the above intentions, and the careful selection of the most perfect animals of the same breed or kind, with due



attention to constant good feeding, the improvement of live stock may be carried to the greatest perfection. Mr. Cline in the paper alluded to above has given many examples of the good and bad effects of the crossing system of breeding.

As the principal object of the breeding farmer must constantly be that of obtaining such animals as will afford him the largest profit, it may be necessary to ascertain the nature and form of animal that may be most advantageous in this view, or which pays the best for the consumption of its food; as by this means it will be seen what points are the most desirable or useful in a breed or variety, and what circumstances ought to be attended to, so as to justify its introduction in preference to another.

The properties that would seem more particularly to deserve the attention of the farmer, in his different views and schemes of improving the breeds of live stock may be considered under the different heads of *shape, size, disposition, hardiness, quick maturity, nature of flesh, fattening property, milk, hide, aptitude for labour*, and what may be termed the quality of the breed, or, in the language of the art, *blood*.

In respect to the first, the ideas or opinions of breeders have differed very materially; but it is obvious, that there can only be one true or perfect form, which must be that which approaches the nearest to exactness in the shape and proportion of the different parts. Whenever this is met with, it indicates the true form, and is that which ought to be aimed at by the breeder, whatever the nature or breed of the animal may be.

In this view, a perfectly formed animal should have an exact proportion and consistency in all the different parts; the head neat and compactly formed, but neither too large, or of too great a length; the eyes bright and prominent; the neck not of too great length, but somewhat thin, gradually narrowing from the breast towards the head, to which it should be neatly attached; the chest round, wide, full, and of deep girth; the length of the legs well proportioned to the size; the fore ones straight and clean, the hind ones forming an angle at the hock, so as to stand well under the loins; the distance between the feet in the different extremities equal; the feet round and even; the hoofs straight; the back and loins straight and broad; the belly firm and capacious; the quarters deep, full, and well fleshed downwards.

It is, however, difficult to convey any very correct idea of shape by words; but that which comes up in some measure to this standard would seem to constitute that "utility of form" which has been the great object of modern breeders. And it is probable that such a form is best calculated for the chief object of the farmer, which is that of receiving and supporting flesh in the practice of fattening; as, where animals much exceed or fall short of such correct proportions of parts, there must be inconvenience or disadvantage, either in their being weak and less disposed to fatten,—of course requiring more food and a greater length of time for accomplishing the business,—or in their being deficient in the general weight and value of the meat, from their not fattening sufficiently on the best parts. It



has been observed to have been the constant principle of a most intelligent breeder, to procure such animals, whether of the cattle or sheep kind, as were capable of weighing “the most in the most valuable joints,” as there is a great difference between an ox of fifty stone, carrying thirty in roasting pieces, and twenty in coarse boiling ones,—and another carrying thirty in the latter, and twenty in the former. It must undoubtedly be an object of great importance to have those parts which are of but little value as small and of as little weight as possible. It may also be advantageous in particular cases, to attend to the nature of the consumption in the shape of the animals, in the manner that has been just seen, as, where some parts are more in demand than others, and consequently sell at much higher prices, that shape which is most favourable for this purpose should be more attended to.

It is probable, however, that it is on the just proportion and symmetry of parts in the animals that are employed for the purpose of the breeder, that improvement in this as well as other important points must depend. And of course it seems not improbable, but that the excellence of the most valuable points in all the different sorts of stock may in some degree bear a proportion to the goodness of the form in the animals.

That fine fullness of shape which has been distinguished by breeders under the term “beauty of form,” has been considered as distinct from that of “utility of form,” and to consist in a more perfect rounding of the parts, and a less appearance of bony protuberance. But though it must constantly be a very desirable object to bring the shape of the animals as near perfection as the difficult nature of the business will admit, yet utility, or what may in other words be termed profit, must be principally considered, as being the immediate object of the stock-farmer.

In the size of animals there is a variety which admirably adapts them to the variations of soil, climate, situation, and food, as well as the different views and purposes of the farmer.

The long agitated question, whether large or small-sized animals are the most profitable, or pay the grazing farmer the most money for the food they consume, is not yet fully decided; nor is it probably capable of being easily ascertained, on account of the great difficulty of making experiments under an exact similarity of circumstances, in regard to breed, pasture, food, exposure, and other points; and what is the difference in the growth, or increase of weight, or of labour, between large and small animals, in proportion to the quantity of food which they take for their support. And lastly, what is the difference in the increase and quickness of feeding, in stock of different sizes, in relation to the quantity of food which they consume. A varied set of experiments, correctly made with a view to these different points, would no doubt lead to many useful conclusions, though they would not, probably, finally settle the dispute, on account of the great difficulties that must always attend such comparative investigations, from the variation of circumstances and other causes. It would seem, therefore, that, in the present state of our knowledge, no certain directions can be given, in respect to the



size of cattle, that will be generally applicable in governing the conduct of the grazier. The largeness of size, though it is a property that may be desirable, in so far as it affords the means of feeding to a great weight; yet, as this is probably acquired by a much larger and longer continued consumption of food, it is probable that, except in situations where food is abundant, the smaller-sized animals may be the more profitable. In deciding the point, it is not merely, as has been seen, the difference in the quantity of flesh that they are separately capable of affording, but the difference of such quantity in relation to the consumption of food that is to be considered. It was found by Mr. Bakewell, that the “smaller the bone, the truer the make of the beast,” and the quicker in fattening; which throws the advantage on the side of small size: and the experience of graziers in general seems to favour the same conclusion, as they commonly find that the middling and small breeds are the most profitable, from their fattening with the greatest expedition. And it has been well remarked that the Lincolnshire and Holderness breeds of cattle “are very large, but their size lies in their bones: they may be fattened to great loss to the grazier,” but can never “return so much for a given quantity of grass as the small-boned, long-horned kind.”

It may perhaps be objected by some, that the difference in the consumption of food between the large and small-sized animals is not so considerable as is commonly supposed. But though it must be allowed that considerable latitude may take place in this respect, according to the state of the digestive organs and other causes, long experience among graziers has shown in the most decisive manner, that a number of small-sized stock consume much less food in a given time than large, as in some cases they can stock nearly in the proportion of two to one. Mr. Knight, however, inclines to the side of large cattle being the most profitable, from their not consuming food in the proportion of their weight; as, on putting the question of the difference in the weight of food consumed by the largest and smallest in a given time, to different breeders in different parts of the district where he resides, he found that they agreed “that the same quantity of food was given to the smallest and the largest beast of the same age; that the largest, even when not master of the same fold, often kept itself in the best condition; and that every thing depended on the disposition to fatten, and very little on the size of the animal.” In his own stock he also asserts the same thing to be precisely the case. It is however admitted, as just stated, that a certain quantity of large cattle will mostly consume more than the same quantity of small ones; but not by any means in proportion to their weight.

With regard to any difference that may take place in the quality of the meat from the difference of size, it would seem to be in favour of the smaller breeds; as the fineness of the muscular fibre, or what has been commonly termed the grain of flesh, has been found to be the most delicate in the smaller breeds of animals. It is on this account, as well as that of convenience, that the mutton, beef, and



other sorts of meat of small animals are so constantly preferred by the nice palates of those who indulge in the pleasures of the table.

In opposition to the idea that small animals, when fatted, are in common worth more for any given weight of meat than large ones; it is contended, that if the animal be taken as it stands in the pasture or stall, the contrary is the truth; but that when the butcher merely buys what are termed the valuable parts, and receives the offal into the bargain, he will unquestionably, for obvious reasons, “give more for two cows of twelve stone each a quarter, than for one of twenty-four.” The offal is of much greater value, besides a considerable advantage in the hides. In short, it is concluded that “the difference between the weight of the animals when living, and of the four quarters when dead, is always in an *inverse* proportion to their size when their forms and merits are equal; but the bones will *then* be in proportion to the *living-weight*, and therefore small animals must be in this case *most disadvantageous to the consumer.*”

From the greater size of the muscular parts in large animals, the flesh would, however, seem to be more coarse in the very large breeds, and of course be less valuable than in those of the small.

It is also supposed an advantage in the large animals, that the meat when preserved for future use is not only better, from the juices being more fully retained, but from there being less waste, on account of the external surface being proportionately less.

And it is observed, in regard to the opinion that animals of the smaller kinds are in general more hardy than those of the large breeds, that if it be meant merely that they are capable of subsisting on shorter herbage, it is right; as a large animal, though it may have exactly the same form as the small one, necessarily requires more time for rest. It feeds and removes itself with greater labour; and notwithstanding it may be as strong again, as having double the weight, it will still in relation to itself be a weaker animal. Its head and neck will be as heavy again, and from their greater length, the weight will recede further from the centre of motion in the shoulder, consequently increase in power in proportion to the distance; and the same thing holds good in respect to the whole of the limbs. In the stall, or the fold, where large oxen are mostly fed, these disadvantages are of no consequence, as the food is received without the trouble of looking for it: and if the necessity of a better pasture does not proceed from the larger animal consuming much more, but from less power in collecting food, the consequence will be, that it must “afford the largest weight of flesh with the smallest consumption of grass.

Small-sized animals have been asserted to be less prejudicial in poaching the ground than large ones, on account of their feet being wider in proportion to the weight. It is however observed by Mr. Knight, that “the question is, whether the feet and mouths of two small animals will not injure the herbage more than that of one large one.” It is remarked that small sheep do not poach the ground at all: yet it is supposed that “a score of these weighing a ton in the aggregate will do more injury to a rich pasture in forty-eight



hours than an ox of the same weight in a week." Cows and oxen should, it is said, be kept in the stall and the fold when the ground is wet during the winter, and capable of being injured by poaching; and in the summer it is not injured by the heaviest stock.

In cases where the weight of meat is of no material consequence, as in dairy cattle, the advantage may be on the side of small animals, as such cows will give nearly the same quantity of milk separately as those of the large kind; and are capable of subsisting on shorter herbage, and without injuring the ground in the same degree: but where the weight and value of the meat form the principal considerations, the largest animals the pastures are calculated to support are supposed to be the most beneficial to the breeder and the public.

In the smaller-sized animals there are, however, advantages in their being capable of being fattened wholly with grass, without having recourse to the more expensive kinds of food, which must be the case with those of a large kind, and on pastures of inferior qualities; in their being procured with less difficulty, and more adapted to particular situations and circumstances of farmers; and from there being less loss in case of accidents taking place.

On these grounds, as there appear some things favourable to each side, the attention of the breeder should be principally directed by the nature and circumstances of his pastures, as well as the command of other sorts of food which he possesses; the middle and smaller breeds of live stock being preferred on the less rich and inferior kinds, and the large sorts in such situations as are more rich and fertile, and wherever there is a sufficient command of food.

It is, without doubt, a matter of much utility and importance to have such breeds of domestic animals as are possessed of tame and gentle dispositions, without being too dull or sluggish in their habits, as such animals are not only less disposed to ramble and break the pastures, but are capable of being reared, fed, and rendered fat, with considerably less food. In the production of this sort of disposition much depends upon the modes of rearing the animals. Mr. Bakewell had all his animals, even his bulls, so tame and gentle, from early care in this respect, that they could be managed with the greatest ease and facility.

Hardiness of constitution is another property in live stock that deserves the attention of the breeder. In exposed situations it is an essential and indispensable property; and under all circumstances, it must be advantageous for the farmer that a breed is not liable to disease. Besides, hardy animals always thrive much better than such as are more tender and delicate in their nature. The circumstances which have been commonly supposed to denote this disposition are those of darkness of colour and roughness of hair. Animals of other colours are however frequently not deficient in this property; and it does not seem to depend much upon the colour, but perhaps on the breed, and the manner in which the animal has been reared.

There is another property which is of great consequence to the breeder, as much of his profits must always depend, in a great degree, upon it. This is that of quickness in arriving at the state of matu-



richness. With this the abundance of supply is likewise, in a great measure, connected: of course it is a property that greatly interests the public as well as the farmer, and on both accounts deserves the particular attention of the breeder. It is probable that some sorts of stock, from their labour, or the produce which they afford, may be kept longer with profit by the farmer than others. This has been supposed to be the case with neat cattle, though not with sheep; but the distinction is perhaps not well founded, as the latter obviously afford a return in various ways.

It is evident that the manner in which animals are fed must have much influence in this respect; as when, from the constant full supplies of food, they are always kept in a thriving condition, they will of course arrive much earlier at the state of maturity than under the contrary circumstances. This will be the case, whatever the nature of the stock may be. It has been asserted that, under this mode, a greater progress is made in three years than in the ordinary pinching method of rearing is effected in five. The necessity of not suffering animals to be checked or stunted in their early growth, by the want of proper care, food, and warmth, is thus fully evinced. This is, therefore, a point that should never be lost sight of by the careful breeder in the raising of his live stock.

It is scarcely necessary, after the observations that have been made above, to say any thing in addition respecting the nature or quality of the flesh of animals, as it would seem to be a property inherent in the muscular substance, and probably depending in a great measure, if not wholly, on the breed. It is indeed observed by Mr. Marshall, in speaking of the breeding of animals in the Midland districts, where the *flesh* is “spoken of with the same familiarity as the hide or the fleece,” that the grain is clearly understood to depend wholly on the *breed*, and not, as has been heretofore considered, on the *size* of the animal.”

The difference in the flavour of the flesh of different breeds or varieties of animals would seem to depend in a great degree on the nature of the food; while that of colour is probably in a great measure fixed and inherent, and the effect of breed: experiments are however wanting on these points, in order to place them in a more clear light. The supposition of its having a relation to that of the colour of the skin is probably without any just foundation.

Wherever any very material deviation from the natural colour of flesh is met with in meat, as has sometimes been the case, it is probably the effect of a morbid condition of the animal. In the living state, the proofs of good flesh are a mellow, elastic, rather firm feel, without any degree of harshness; and in the dead condition a similarity of feel, with a fine grain and marbled appearance. The difference of age and sex may likewise afford some variety in respect to the quality of the flesh, as in old animals it must be more firm, and less tender and juicy, than in those that are young, as is found by experience. And the fineness of the grain is mostly found much greater in animals of the female than the male kind. Some of the more northern breeds of Scotch cattle are said to excel much in the quality of their flesh, when well fattened and killed at a proper age.



There is another property, in some degree connected with that just mentioned, which is that of the disposition to fatten while young, and in an expeditious manner, when fully fed. This is a property on which the profit of the grazier must in a high degree depend, as where it does not prevail, much of his food must be uselessly expended. It cannot therefore, in this view, be too much regarded in the selecting of his stock. The circumstances on which it depends have not, perhaps, yet been fully investigated; but it is well known that some animals become fat with a very small consumption of food, while others that eat much larger proportions always remain in a lean state. So far as observation has yet gone, this is a property that would seem to be in some measure connected with smallness of bone. Some think it “probable, however, that a tendency to fatten arises from some particular circumstance in the internal structure of the body, of which small bones are in general an indication; and that it is only in this point of view that they ought to be considered essential: for they often weigh as heavy, and consequently require as much nourishment, as large ones;—small bones, like those of the blood-horse, being compact and heavy; large bones like those of the common dray, or cart-horse, being extremely porous, and consequently light for their apparent bulk.—Indeed, cattle ought not only to be easily maintained in point of quantity, but, in remote and uncultivated districts, in regard to the quality also of the food they consume; and it is certain that some particular animals will fatten as well on coarse fare as others will do on the most luxuriant.” The practice of Mr. Bakewell, as well as that of other breeders, would seem to demonstrate that it depends greatly on the form and breed of the animals.

Some have affected to think less favourably of the utility of this property or disposition, on account of the largeness of the proportion of fat that is sometimes produced, which is conceived by no means so useful or economical, in the consumption as food, as that of the lean part. But where a superabundance or excess of fat takes place, it would seem to be in a great measure the fault of the grazier, and not of the nature or disposition of the breed.

It has been suggested, that the disputes in respect to the utility or inutility of fattening animals to the great degree that has been lately the custom must of necessity proceed from the want of sufficient discrimination; as fat meat, though not so fit for common use, is in general considered as affording more nourishment than lean, when the state and vigour of the stomach are suitable for digesting it; and that although there may, in the common methods of cooking it, be some loss, by proper care and attention there are ways in which this may be almost wholly avoided. Thus it is remarked that “the keelmen of Newcastle purchase great quantities of fat meat, as they follow the custom so usual in Scotland of boiling their meat; the broth of which feeds the family, whilst they themselves eat the meat, generally in a cold state, and in great quantities; and are thus enabled to go through the heavy labour they usually undergo. In many districts, manufacturers and others bake their meat with potatoes under it; and the fat, melted by the fire, falls upon the potatoes, and



improves much their taste, and the nourishment to be derived from them. In either of these ways little if any of the substance of the meat is lost."

But such suppositions as the above are probably futile on other principals, as there does not appear to have yet been any other discovery made for increasing the quantity of muscular substance, or lean flesh, than that of cultivating the fattening property of animals. It has long been an observation among breeders and graziers, that "good fat makes good lean." The importance of this propensity is therefore considerable, and requires the particular notice of the modern breeder in the raising of his live stock.

There remains another property that ought to be regarded in the breed of animals, as it in some measure furnishes the means of determining the disposition to fatten by the feel which it affords. This is the state of the hide or skin. It is remarked that "when it feels soft and silky, it strongly indicates a tendency in the animal to take on meat; and it is evident that a fine and soft skin must be more pliable, and more easily stretched out to receive any extraordinary quantity of flesh, than a thick or tough one. At the same time, thick hides are of great importance in various manufactures. They are indeed necessary in cold countries, where cattle are much exposed to the inclemency of the seasons; and in the best breeds of Highland cattle, the skin is thick in proportion to their size, without being so tough as to be prejudicial to their capacity of fattening.

The property of supplying in large proportions a useful product, such as that of milk, is an object that should not be lost sight of by the breeding farmer. The question of the propriety of having a distinct breed exclusively for this purpose, or that of having it only partly calculated for this use, and partly for that of the butcher, has not yet been fully decided: but as it has been found, by long experience, that such cows as have much propensity to fatten, seldom answer the purpose of the dairy, it would seem that there ought to be a breed particularly for the pail. It has however been suggested as probable that, "by great attention a breed might be reared, the males of which might, in every respect, be well calculated for the shambles, and the females, when young, produce abundant quantities of good milk, yet, when they reached eight or nine years of age, be easily fattened." Such a breed would, it is supposed, be of the greatest value of any that could be produced. Some of the best English and Scotch breeds are believed to have nearly attained this point of perfection.

The fitness of animals for the purpose of labour is a quality that, in certain circumstances, may be necessary to be considered in the breeding of cattle stock. The question of the advantage that may be gained in this practice, in regard to the increase in the quantity of meat, is far from having been decided; nor has it been well explained whether injury may not be done in restricting the growth of the animals by this means, more than can be compensated by their labour. It is obvious, however, that where cattle are worked, they must be longer in being brought to the market. But as, from the greater cheapness of rearing and keeping neat cattle than horses, and



various other causes, it may be necessary to make use of cattle for the purpose of labour, a breed well calculated in this respect must be desirable.

There still remains another property which it is requisite for the breeder to consider in the improvement of live stock, which is that of *blood*, adopted in analogy to the system of breeding in the race-horse. It is employed to signify the natural, fixed, and inherent properties of a breed or kind, as exemplified in their external appearances. Its utility for the purposes of the breeder is therefore to enable him to discriminate, with greater nicety and correctness, in the selection of such animals as are the most adapted to the improvements he has in view.

These are the main objects to which the breeder should attend, and the means by which he is principally to effect his improvements. The success of his endeavours, to whatever species of excellence his attention may be directed, must obviously in a great measure depend upon the accuracy and correctness of his judgment in choosing those breeds, of whatever sort of live stock they may be, that are most adapted to his circumstances; and in selecting such individuals, both male and female of such breeds, as are the most perfect and exact in their different parts and properties: cautiously continuing to breed from them, without ever suffering the least intermixture by the admission of those of inferior qualities: advancing in this way with the nicest attention to such faults or defects, however trifling, as may arise, so as to alter and correct them by appropriate pairing in the succeeding generations. And as an indispensable assistant in this arduous undertaking, he must constantly have recourse to the aid of good and abundant keep at all seasons, with suitable degrees of shelter and warmth for both the old and young stock; so that they may never decline in flesh or be checked in their growth. This would seem to constitute the great secret of the important art of breeding live stock, which the superior discernment and unwearied perseverance of a single individual raised to a degree of notice and perfection that has had the happiest effects in bringing the improvement of our domestic animals to a state of excellence perhaps unequalled in any other country.

In every system of breeding or improving of live stock, the greatest attention is consequently necessary to keep. It has been well observed that "all good stock must be both bred with attention and well fed: and that it is necessary that these two essentials in this species of improvement should always accompany each other: for, without good resources for keeping, it would be in vain to attempt supporting a capital stock, and with such resources it would be absurd not to aim at a breed somewhat decent in quality." But improvements of this nature can, in general, only be effected by degrees, as the pecuniary circumstances of but few farmers admit of a total change. How much soever they may disapprove of what they have in possession, they can only object to a few of the inferior: this, however, is in their power; and, by always selecting the best for breeding and rearing, improvement will in time be effected. Great improvements in cow-stock may doubtless be made by a proper



selection of the best heifers in carcase and milk-bag for breeding stock, but more particularly by a judicious choice of the bull. But as prime or first-rate stock is in but few hands, and the owners generally ask higher prices than farmers in general can afford to give, it would be highly advantageous in this intention to have proper male stock provided by the proprietors of lands. In this way, the letting of male stock in the midland districts has had much influence; and it is probably only by some encouragement of this nature that the highest improvement in this important department of husbandry can be attained.

It has been also remarked, “that there is one circumstance relative to the choice or introduction of all new breeds, which must not be passed over in silence, because no farmer can neglect it without certain loss. Every kind of pasture is fitted to raise animals to a particular size. When beasts of a larger size are brought in than the quality of the food is calculated to support, these animals, whether cows, horses, or sheep, or any other kind, will degenerate apace, and never prove useful until they come down to that standard or size adapted to their situation and suited to their food. On the other hand, when a smaller breed than ordinary is brought in, they continue to increase in bulk, until they come up to the pitch which is suited to their nourishment. But there is this remarkable difference betwixt these two progressions in respect of profits, that in the retrograde progress, when animals are brought from rich pastures and a comfortable situation to the reverse, they are in every instance worse than the indigenous breed; whereas the animals which are brought from worse to better continue to improve till they arrive at that perfection which the change in their situation is calculated to produce. These causes may not immediately have their full effect, but in a few years they certainly and evidently will. He makes for this reason a much safer experiment who brings cattle from worse to better, than he who brings them from better to worse. This reasoning applies to all plants as well as animals. Highland cattle rise to a great size, not only by the keeping in South Britain, but in rich pastures at home. In vain will you attempt to improve a breed of animals beyond the circumstances of the country as to climate and pasture; while at the same time, it is no easy matter to discern without proper trials how far these circumstances can support a better stock.” In confirmation of these observations, and others that have been stated above, it has been observed that the “richest grazing land, and the most nourishing artificial food, will certainly pay more in feeding large bullocks, sheep, and swine, than it would do in feeding the smaller sizes of the same species; and it is equally obvious that the smaller breeds will answer better on the poor pasture than the large. Besides these circumstances, in the introduction of new breeds of live stock, there are others that demand attention, such as the particular qualities or properties which the farmer has in view. These must be fully considered; and such a breed as may best answer in these particular intentions be constantly preferred.

In speaking of the vast advantages that may be derived from the improvement of live stock, it has been observed by a late practical



writer, that considering the various breeds of domestic animals as the machines or vehicles by which farmers are enabled to send their herbage and other sorts of food to the markets, they ought by the study of every suitable means to promote their improvement, both in respect to form and the disposition to fatten, in order that the produce of their farms may be disposed of in the most profitable manner; and that, independent of the benefits the farmers would individually derive by such means from the breeds being rendered less tedious in fattening and less productive in offal, the public would obtain vast advantage in the great increase of animal food. Indeed, on the supposition that every individual in England and Scotland consumes in the proportion of one sheep in the course of the year, and that there are ten millions in the country, it is calculated that, by improving the breeds of that animal only to the extent of one shilling, which cannot be deemed impracticable, an additional annual advantage would be gained in that sort of live stock alone of five hundred thousand pounds. This, on the whole of every kind, would therefore be immense.

After this concise view of the principles, properties, and other circumstances which seem most particularly to deserve regard in the improvement of different sorts of live stock, we may examine the nature and qualities of the several kinds, and the methods of management which are most proper and advantageous in each.

*Neat Cattle.*—The breeds and varieties of cattle that are dispersed over the country are so extremely numerous, that no correct enumeration of them has yet been presented to the public, but a few of the more distinguished and valuable sorts have been well described by different writers. Almost every district or county has its particular breed or variety of this sort of stock, which in many cases is unquestionably the most proper and suitable; but in others there is no doubt but that the farmer might be greatly benefited by a judicious change for some other sort more perfectly adapted to his situation and circumstances. It has been usual to arrange the breeds of cattle from the nature of their horns, and other circumstances, some what in the following manner:

The Long-horned Breed.

— Middle-horned Ditto.

— Short-horned Ditto.

— Welch Breed.

— Suffolk Dun Breed.

— Galloway Polled Breed.

— Highland or Kyles Breed.

— Lowland or Fifeshire Breed.

— Alderney Breed. And the

— Wild Breed.

The breeds of cattle are also frequently distinguished by the names of the particular districts, counties, or places where they are the most prevalent or the most perfect of their kind.

The *long-horned* breed of cattle is distinguished, as the name implies, by the great length of the horns, the thickness and firmness



of the texture of their hides, the length and closeness of their hair, the large size of their hoofs, and the coarse, leathery thickness of their necks. They are also in common deeper made in their fore-quarters, and lighter in their hind-quarters, than other breeds. In size they are said to be superior to the Suffolk duns, but inferior to the short and middle-horned breeds. They are likewise narrower in their shape, and less in point of weight, than the short-horns, though better weighers in proportion to their size; and the cows of this breed give considerably less milk, but such as affords more cream in proportion to the quantity. In colour they are more varied than any of the other breeds; but whatever the colour is, they have generally a white streak along their backs, which the breeders term *finched*, and mostly a white spot on the inside of the hough. It is contended by some that they were the native or original breed of this island; but it is not easy to ascertain the matter: it is however conjectured as probable, that “these have been the inhabitants of the open plain country; whilst the wild breed, or perhaps the Welch and Scotch breeds, possessed the woody, wild, and mountainous parts of the island.

Others, however, think it more probable that “the long-horned breed originated in importations of cattle from the neighbouring country of Ireland; and that bulls and cows brought from that island, having been coupled with the ancient breed of the district, produced the sort of cattle known by the name of the Lancashire or long-horned,” and which now occupy a large portion of the pasture-lands of this kingdom.

Lancashire is without doubt the mother district of this sort of cattle, but the long-horned breed are also the prevailing sort of stock in the counties of Warwick, Leicester, Gloucester, Chester, and several others of the midland counties; and it is surprising, and shows great attention in one instance, and equal neglect in the other, that this sort of cattle are at present found in greater perfection in the county of Leicester than in the district whence they take their name. This is supposed to have arisen “from the graziers of these counties buying their best bulls and heifers, for many years past, before the people of Lancashire were well aware of it. The former paid more attention to that kind which were of a true mould or form, and quicker feeders; while the latter contented themselves with the old-fashioned, large, big-boned kind, which are not only slower feeders, but, when fed, are not such good beef. In short, the little farmers in Lancashire, tempted by the high prices given them for their best stock, had lost their valuable breed before they were sensible of it.”

This breed is commonly understood by graziers to be in general rather slow feeders, except that particular kind selected, improved, and recommended by the late Mr. Bakewell, which are said not only to eat less food than the others in proportion to their weight, but to become remarkably fat in a short space of time, and to lay their fat upon the most valuable parts, yet to have little tallow in them when killed; and, when used in the dairy, to give but little milk. This improved “variety also differs from the rest of the long-horned







*Devonshire Bull.*



*Veale sculp. Strand.*







*Downshire Sterr.*

PL. XCIII. *Pag.* 843.



*Wool sculp Stroud*







*Devonshire Cow.*

PL. XCII. Page 843.



*Wells, sculp. Strand.*



cattle, in having very fine, clean, small bones in their legs, and thin hides. They are a middle sized, clean, small-boned, round-car-cased, kindly-looking cattle." And they are supposed to have been raised by means of Mr. Webster's, or what is frequently termed the Canley stock. Craven in Yorkshire is also famed for a superior variety of this breed of cattle.

The Irish cattle are supposed a mixed breed between the long-horns and the Welch or Scotch, but more inclined to the long-horns, though of less weight than those of this country.

In the *middle-boned* breed of cattle there is probably more variety than in that of the preceding sort. The Devonshire variety, when in a state of the greatest purity, is distinguished by a high red colour, without any white spots, as the breed is reckoned impure when these exist, particularly where they run into one another; by having a light dun ring round the eye; by the muzzle being of the same colour; by being fine in the bone and clean in the neck: by the horns being of a medium length and bent upwards; by being thin faced, fine in the chaps, and wide in the hips; with a tolerable barrel, but rather flat on the sides: by the tail being small, and set on very high; by being thin-skinned, and silky in handling; and by the property of feeding at an early age, or arriving at maturity sooner than most other breeds: they are a sort of cattle well fitted for draught, both as to hardiness and quick movement, and their shoulder-points are beautifully fitted for the collar."

In the Sussex and Herefordshire varieties, the colour is also deep red, with fine hair; very thin skins; necks and heads clean; horns neither long nor short, rather turning up at the points; well made in the hind quarters; wide across the hips, rumps, and surloins; narrow in the chines; tolerably straight in the backs, but the ribs or sides lying too flat; thin in the thighs; bones not large. It is observed, that "when all the properties which should attach to an useful breed of cattle are considered, the middle-horned may be said in general to come nearer to perfection than any other in the kingdom. They are of a large size, well formed, and in disposition to fatten, probably much on a par with the short-horned, and greatly superior to the Suffolk. As dairy cattle, they are also as valuable as any that fall under the description of quick feeders; for although they give a less quantity of milk than the Suffolk or the long-horned, it is said to be of a richer quality."

The Herefordshire as well as North Devon varieties of this breed are indeed a very superior sort of stock both for the purpose of labour and that of grazing, as being not only clean, strong, and well made, but affording quick proof under the feeding system. Mr. Marshall remarks, that the former, with that of the Gloucester variety, is highly eligible as dairy stock. The females in the Herefordshire sort have been found to fatten better than any other kind at three years old; except the spayed heifers of Norfolk.

The North Devon variety, from the fineness of the grain in the meat, is held in high estimation in Smithfield. And they are said to have great superiority over many other breeds, from their possessing more activity, being better calculated for labour, and having



more blood ; and which is believed to arise from the circumstance of their being bred from one and two years old bulls and heifers. Great proof in this sort of cattle is shown by the size of the rib, the rotundity of the barrel, and the mellowness of the skin. The colours that are most in esteem, and which denote a superiority in the animals, are those shades of the mahogany kind, especially where there is a silky or glossy appearance in the hide, with a slight degree of waving or curling in the hair. The ox in this variety is mostly considered in perfection about the fifth year of his age.

This valuable breed of cattle is the most prevalent in the more southern and south-western parts of this country, as in Sussex, Dorsetshire, Hampshire, Devonshire, Somersetshire, and even so far northward as Herefordshire, where the largest and perhaps the finest variety of this breed of neat cattle is met with. The Sussex variety, though not so large as the Herefordshire, exceeds those of most of the other districts. The oxen in the Herefordshire sort, when six years old and fattened, will in general weigh from sixty to one hundred stones of fourteen pounds, the fore quarters being mostly the heaviest. From their being steady and active, as well as capable of great exertion in harness, they are peculiarly adapted to the purposes of the team. They may be wrought from three to five or six years old before they are fattened.

The *short-horned* breed, as the term signifies, is distinguished from the others by the shortness of the horns ; by being wider and thicker in the form or mould, and, of course, feeding to the greatest weight by affording much the largest quantity of tallow when fattened, in having very thin hides, and much less hair upon them than any other breed except the Alderney ; and more particularly by the quantity of milk they give beyond any other breed. The great quantity of milk, thinness of their hides, and little hair, are probably the reasons why they are tenderer than any of the other kinds, except the Alderney. It is perhaps justly said of this kind, that they eat more food than any of the other breeds, a circumstance which cannot be wondered at, when it is considered that they excel in those three valuable particulars, viz. in affording the greatest quantity of beef, tallow, and milk. Their colours are much varied, but the generality of them are red and white mixed, which, when properly blended, is very pleasing and agreeable.

This is a breed chiefly found in Lincolnshire and the eastern parts of Yorkshire, Durham, Northumberland, and Berwickshire. In consequence of its having been originally imported from Holland, it is frequently called the *Dutch*, and sometimes the *Holderness* breed, from a place of that name in Yorkshire, where it is probable it was first established. As being destitute of the exertion and agility of the middle-horned sorts, they are not so well adapted for the cart or the plough. And considering their size, and the quantity of food they devour, it is probable that they are inferior to any of the above-mentioned breeds ; and, when compared with the Suffolk dons, very greatly so. This breed has been lately much improved in Yorkshire, where the best of the kind are to be met with.

It is remarked, that “ the long-horns and these have met upon



the mountains which separate Yorkshire from Lancashire, &c. and, by crossing, have produced a mixed breed, called *half long-horns*; a very heavy, strong, and not unuseful kind of cattle."

The *Welsh* breed of neat cattle, especially that which is found in Cardiganshire, is mostly black, with thick horns turned upwards; small in size; clean boned; well-shaped, especially where the native breed has not been injured by injudicious crossing with other sorts. This breed is hardy and active, and in great request in the southern counties of the kingdom, on account of the cattle being quick feeders. The quantity of milk which the cows afford is not large; but they are a breed well adapted to the country in which they are found, though capable of great improvement by selecting the best individuals of the native breed.

The *Suffolk Dun* breed is a sort of neat cattle found to prevail in that district; and which are easily distinguished by their being polled, of small size, and a dun colour. They are mostly plain in their form. The cows are lean, and large in their bellies. They are valuable for the purpose of the dairy, as the cows give large quantities of milk. The weight of this breed of cattle is mostly on the average from fifty to sixty stone. The author of the *Treatise on Live Stock* seems to think this only a variety of the following breed, produced in consequence of the great connection between the Scotch drovers and the Suffolk and Norfolk feeders, as both sorts are in general polled; and though the Suffolk are mostly light duns, while the others vary greatly in colour, this might take place from some partiality to that colour.

The *polled* or *Galloway* breed of cattle is also very valuable. In weight and size, it is as much less than the long-horns as these are than the short-horns. The cattle generally weigh from forty to sixty stone, some particular ones reach seventy and upwards: but their most essential difference from every other breed of cattle is their having no horns at all: some few, indeed, in every other respect polls, have two little knobs, from two to four inches long, hanging down loose from the parts where other cattle's horns grow, joined to the head by a little loose skin and flesh. In most other respects these cattle resemble the long-horns both in colour and shape, only they are shorter and more compact in their form; which probably makes them weigh less. Their hides seem to be in a medium state, not so thick as the long-horns or so thin as the short-horns; but, like the best feeding kind of long-horns, they lay their fat upon the most valuable parts, and their beef is well marbled or mixed with fat.

The origin of this breed was probably in Galloway, a large district in the south-west of Scotland, where they are mostly bred upon the moors or hilly country, and grazed upon the lands nearer the sea until rising four or five years old, when the graziers and drovers take them up in great numbers to the fairs in Norfolk and Suffolk, previous to the turnip-feeding season; whence the greatest part are again removed in the winter and spring, when fat, to supply the consumption of the capital, where they are readily sold at high prices, few or no cattle selling so high in Smithfield market, from



their cutting up so nicely, owing to their laying their fat upon the most valuable parts;—a great excellence in all feeding cattle. They also prevail in Dumfriesshire and Ayrshire.

The polled cows of this breed are said to be good milkers in proportion to their size, the milk being of a rich quality, and yielding much more butter from a given quantity than in the short-horns. The oxen and spayed heifers have also been asserted to answer well for draught. They are probably, however, in general too small for this purpose.

But though the cattle of the above district are mostly polled, they have several with horns, which they contend are a bastard or mongrel breed, produced by crossing with long-horned bulls from other districts. The polled ones, and of these the black or dark brindled ones, are preferred to any other, as they allow them to be the original breed of the country. The breeders in Galloway, however, complain of their old breed being lost, or at least much worn out.

The *Highland* or *Kyloe* breed of cattle is less in proportion to the polled cattle than they are to the long-horns. This breed is also covered with a long close coat of hair, like the polls and long-horns; and, like these, the beef is fine-grained, well-flavoured, and mixed or marbled, but not so handsome on the outside when exposed in the market, not being so bright a colour, and often spotted with black, even upon the best parts, except when made very fat. When grazed, they feed very readily, their weight in general being from twenty to thirty-five stone; some particular ones reach to more than forty-stone. The most prevalent colour is black; some are brindled or dun; but the breeders there, like those in Galloway, prefer the black ones.

This hardy breed is in possession of all the extensive mountainous country, the Highlands of Scotland, together with the Western Isles. The Isle of Skye cattle are the smallest in size, but the most perfect in other respects of perhaps any of the Kyloe or other sorts; a circumstance which is supposed to depend on its being a pure unmixed breed. The removal of the imperfection of size deserves the attention of the breeder.

This breed is probably calculated in every respect to thrive in a cold, exposed, mountainous country, and probably better adapted to the cold regions where they are bred than any other kind. They are driven to the southward in great numbers every autumn; many into the western districts of Yorkshire, but the greatest part into Norfolk, Suffolk, Essex, and other parts of the south, where they are fattened. This sort of cattle is frequently termed *kyloes* in Scotland, probably from a district in Ayrshire called Kyle, where they prevail much.

The *Lowland* or *Fifeshire* breed of cattle is rarely met with in an unmixed state. "Towards Cumberland the cattle are half long-horns, half polls; on the borders of Northumberland they are mixed with short horns, until you reach Tiviotdale, where they become altogether a small coarse kind of short-horns, or what the Yorkshire jobbers call *runts*; except a few pretty good short-horned cattle, bred in that pleasant and fine country, the Tweedside."



This same kind of runtyish coarse breed continues all the way to the Frith of Forth. Crossing this narrow sea into Fifeshire, it might at first be imagined that the Fife cattle were a distinct breed, from their upright white horns, their being exceedingly light lyred, and thin thighed: but Mr. Culley is pretty clear that it is only from their being more nearly allied to the kyloe breed, and consequently having less of the coarse kind of short-horns in them. The cattle all along this coast continue to change more and more, growing still less, until, upon the edges of the mountains, they become quite of the kyloe kind; but still much inferior to that pure, unmixed, valuable breed of kyloes which occupy the more northern and western Highlands, and the different isles; but particularly the Isle of Skye, and that tract of country called Kintale.

The *Alderney* breed of cattle is very delicate and tender, so as to be little attended to by farmers. They are not able to bear well the cold of this island, particularly the more northern parts of it. They are in general fine boned, light red or yellow in colour, and their beef generally yellow or very high coloured, though very fine in the grain, and well-flavoured. They make themselves very fat; and are not in the least subject to lyer, or have black flesh. Very useful cattle have been bred from a cross between an *Alderney* cow and a short horned bull. This is a breed that is mostly to be met with about the seats of the nobility and gentry, upon account of the cows giving exceedingly rich milk.

Besides these different sorts, there is a *wild breed* of cattle, which, as they appear in the breed at Chillingham-Castle in Northumberland, the seat of the earl of Tankerville, “are invariably of a cream colour, with black muzzles; the whole of the inside of the ears, and about one-third of the outside, from the tips downward, red; the horns white, with black tips, very fine and bent upwards: some of the bulls have a thin upright mane, about an inch and a half or two inches long. The weight of the oxen of this breed is from 35 to 45 stone, and the cows from 25 to 35 stone the four quarters, 14lb. to the stone. The beef is finely marbled, and of excellent flavour. From the nature of their pasture, and the frequent agitation they are put into by the curiosity of strangers, it is scarcely to be expected that they should get very fat; yet the six-years old oxen are generally very good beef: whence it may be fairly supposed that in proper situations they would feed well.” They cannot, perhaps from their untameable nature, be of any utility to the farmer, as they are only capable of being retained within walls or very good fences.

It is obvious, from this detail of the various breeds of cattle, that they are not equally profitable to the breeder, the rearer, the dairyman, the Grazier, the butcher, or the consumer. “Some have a greater disposition to fatten than others. Some, being cleaner boned and better formed, have less offal. Some give a greater quantity of milk than others. In a word: some of the particular properties for which cattle is estimable are more discernible in one breed than in another. Whether these can be all united in the same animal, or whether a breed of cattle possessing all the requisite qualifications



would be equally suitable to all situations, are questions not easy to be determined. In regard to the first, it seems universally agreed, that there are two properties for which cattle are esteemed valuable that cannot be united; that is, a disposition to fatten, and a tendency to yield a large quantity of milk. The form of the animal most remarkable for the first is very different from that of the other; in place of being flat in the sides, and big in the belly, as all great milkers are, it is high-sided and light bellied: in a word, its body is barrel formed, while that of the other is more fitted to embrace a horse-collar with the wide side downwards. It is not probable, therefore, that the properties of two breeds of cattle, so opposite in form and general appearance, can ever be united in the same animal. If a large quantity of milk, whatever be its quality, is the object, the dairyman must content himself with such plain ill-looking animals as have been described. And as the milk of all cows is well known not to be of the same quality, it appears highly probable, that in proportion as the cows of the milking tribe exceed those that are more disposed to fatten in quality, in nearly the same proportion will their milk be inferior in quantity. If this should prove to be the case, the superiority of the quick feeders one would suppose to be completely established; as, while cattle of this description are confessedly better for the purposes of the graziers, the butchers, and the consumers, they would, if this point were determined in their favour, be also more valuable for the dairy. No person will think of asserting, that a gallon or two of whey or of butter-milk extra (for the question comes to that) is a sufficient reason for preferring a breed of plain-looking, ill-formed cattle, to one that, except in this particular, is more valuable in every respect. In a word, no person, who pretends to a knowledge of the different breeds of cattle, will think of supporting an opinion so erroneous, as that cattle which are disposed to fatten quickly, and at an early age, that, from the superior excellence of their form, have a small proportion of offal, or what the breeders call non-essentials, and that, although they yield not a large quantity of milk, yet make up for that deficiency in the richness of its quality, are not more valuable than those which have nothing to recommend them but the single property of being great milkers."

Mr. Culley, in comparing the breeds of long and short-horned cattle, contends that the former excel in the hide, hair, and quality of the beef; the latter in the quantity of beef, tallow, and milk; and that though each breed has long had, and probably may have, its particular advocates, it is not improbable but that each may have its particular advantages in different situations. Thus the thick, firm hide, and long close-set hair, of one kind may be a security against those impetuous winds and heavy rains to which the west coast of the island is subject; while the more regular seasons and mild climate upon the east coast may be more suitable to the constitution of the other.

In regard to the former breed exceeding the latter in the quality of the beef, it is only to the particular variety selected and improved by Mr. Bakewell that preference is to be given in this view; for, as



to the long-horned breed in common, it is supposed that their beef is rather inferior than superior to that of the generality of the short-horned kind; and there is little doubt, it is imagined, "but a breed of short-horned cattle might be selected, equal if not superior to even that very kindly fleshed sort of Mr. Bakewell, provided any able breeder, or body of breeders, would pay as much attention to these as he and his neighbours have done to the long-horns. But it has hitherto been the misfortune of the short-horned breeders to pursue the largest and biggest boned ones for the best, without considering that those are the best that pay the most money for a given quantity of food." Such improvements have lately been made in the breeding of short-horned cattle, that they have now been brought to a considerable degree of perfection.

But, notwithstanding these two breeds have hitherto been in possession of the best part of the island, it is suggested that the Galloway cattle, and even the Scotch or Kyloes, might be bred with advantage in many situations, so as to be more profitable than either the short-horns or the long horns, as being "true quick feeders and kindly fleshed."

It is likewise conceived that the latter of these sorts is better adapted to cold moory exposed situations than any other breed, and that particular breeds are probably best adapted to particular situations; on which grounds it is recommended to breeders of cattle to find out which breed is the most profitable and best suited to their situations, and to endeavour to improve that breed to the utmost, rather than try to unite the particular qualities of two or more distinct breeds by crossing; which is a precarious practice, as it is generally found that "the produce inherit the coarseness of both breeds, and rarely attain the good properties which the pure distinct breeds individually possess."

In the providing of cow-stock, great attention is necessary in having them bred from such cows as are known to have produced not only good milk in a large proportion to their size, but to have continued it for a great length of time. Well fed and vigorous bulls should likewise be constantly employed, as by this means the best and most healthy stock may be raised. The method of rearing the calves while young has been already described.

The breeding and rearing of cattle-stock is a business that may be accomplished upon most farms of any extent, but to the greatest advantage on those where the quantity of coarse pasture is the most considerable, and where at the same time there is the means of raising large crops of the green vegetable kind for winter use, as in such cases the animals while young are capable of being kept in the best manner and at the least expense. On very small farms the rearing of young cattle can seldom answer, as the produce in most instances may be turned to much more profit in other methods of management. But in whatever situations the breedings and rearing of cattle stock is attempted, the young animals should constantly be kept in the best manner the nature of the farm will admit of. This is of much greater consequence than is generally allowed in the raising of good stock. But where young animals are pinched



for food at an early period of their growth, or fed with such as is not of a sufficiently good quality, they never thrive so well afterwards, or make such good stock. This is a fact that has been frequently noticed in respect to swine; and it does not seem to be less established in regard to other sorts of stock. But, besides good feeding, cleanliness is essential in raising young stock to the greatest advantage. It has been well observed in a late useful practical work, that in the winter the yearlings should “be fed with hay and roots, either turnips, carrots, or potatoes; and they should be thoroughly well fed, and kept perfectly clean by means of litter. At this age it is a matter of great consequence to keep such young cattle as well as possible: for the contrary practice will inevitably stop their growth, which cannot be recovered by the best summer food. If hay is not to be had, good straw must be substituted; but then the roots should be given in greater plenty, and with more attention. To steers and heifers two years old, the proper food is hay, if cheap; or straw, with baits of turnips, cabbages, &c.”

Mr. Donaldson thinks the advantage of green winter food for live stock so great, that there is no way in which it can be applied with greater benefit than “by giving the young cattle a daily allowance during the first two or three winters.”

Whenever straw is employed as fodder for young stock without the above sorts of food, if it be not very good, or slightly mixed with some grassy material, a little hay should always be blended with it, in order that it may be preserved in proper condition. It is also of consequence that the animals be served with this sort of fodder in a regular manner, as, where too much is given at a time, Mr. Marshall has remarked that they do not thrive so well.

There is another circumstance which is of material importance in the wintering of young stock, which is that of keeping them more warm and sheltered from wet than is usually the case, as by this means they thrive faster, with a less consumption of food, than in the contrary circumstances. This may be effected either by tying them up in stalls, in houses for the purpose, or by keeping them in good sheds in well-inclosed yards.

There are several reasons for keeping young cattle-stock of different ages distinct from each other, both in their winter and summer keeping. It is obvious that in this mode they feed with less interruption and inconvenience to each other. And it is remarked by Mr. Young, “that it is not right to keep yearling calves and two-year olds together, because, in general, the younger the cattle are, the better they should be fed.”

The question of feeding the cattle tied up, or loose in the yards, in winter, has not been yet decided. Each method has probably advantages. In the first the cattle thrive better when left at liberty to run about the yards. Mr. Marshall found that in Yorkshire, cattle kept tied up and regularly fed with straw in a moderate proportion did better than in the southern parts of the island, where left loose in the midst of greater plenty. Whether this effect is to be ascribed to the greater warmth, the resting better, the breed, or the being fed more regularly and *eating with an appetite*, he cannot



determine. Some experiments of Mr. Young's also lead to the conclusion, that cattle-stock thrive better when tied up. They likewise show that the practice of tying up is the only one that can be had recourse to where straw is not in great plenty, and the quantity of the stock very inadequate to its consumption.

In the latter method there is the advantage of a larger supply of manure, especially where the farmer has the convenience of plenty of litter. Where, however, the farmer has convenience, the former method is probably in general the most beneficial. In either mode of management much attention is necessary to keeping the stock constantly supplied in an evenly proportioned manner, as in this way there will be great advantage both in the saving of food and the condition of the animals.

The most proper age at which cattle should be made to become productive is a point of much importance, but which probably requires more experiments that have yet been instituted to fully ascertain it. Much may perhaps depend upon climate, situation, and the manner in which they have been reared and kept; as where the situation is favourable and the keep rich and good, they may be employed in this way earlier than where it is more exposed, and the keep indifferent.

This is supported by the observation of Mr. Marshall, that in Yorkshire, while the lands were in the state of commonage the heifers "were frequently kept from the bull until they were three years old; now, in the state of inclosure and improvement, and at the present high rents, they are frequently suffered to take the bull when yearlings, bringing calves at two years old. The arguments for bringing heifers in at two years old are, that they come sooner to profit: and that farmers cannot afford, at the present rate of rents, to let them run unprofitably, until they be three years old. On the other hand the argument in favour of bringing them in at three years old is, that not being stinted in their growth, they make larger and finer cows than those which are suffered to bear calves at a more early age."

The cow takes nine months and a few days in most cases to complete the business of gestation, and seldom produces more than one calf at a time. A cow may produce her young at any season of the year, but it is of great consequence to the farmer to have the cows calve as early as possible in the beginning of the year, while veal and all the products which they afford are dear, and that the calves when reared may be got forward in the best manner. In some districts, farmers think it the most advantageous for them to calve when there is a full bite of grass, especially in the first calf, as they are supposed to be reudered better milkers thereby afterwards, in consequence of the secretion of the milk being more completely established.

In all cases the cow stock, especially that part of it which is in calf, should be as well kept and sheltered from cold and wet in the winter months as the nature of the farm will admit. By keeping the cows in good condition in this way, they not only calf with greater safety, but take the bull again much sooner, and are more



advantageous in their milking. The practice of foddering with straw should be as much avoided as possible, and the method of management that has been already recommended adhered to as much as can be.\* The farmer may indeed take it as a certain rule, that no benefit can be derived from bad keeping in any sort of breeding animals.

The vigour of the bull will last several years, if not made too free with while he is young; but he is usually in his most perfect state from two or three years old to five or six. These animals should be kept in well-inclosed places, and have the cows brought to them. The practice of working them is not in general to be advised, as they are apt to become by that means too dull and heavy for leaping. They should always be kept well in this intention. In rearing young bulls they should be constantly supplied with food in a plentiful manner from the period of their being calved till they are full grown. Mr. Bakewell was so convinced of the advantage of plentiful support in these cases, that he is said to have employed two cows in rearing some of his best stock of this kind.

In raising oxen, whether for the purpose of sale or work, they should be kept constantly in tolerable condition, without ever being suffered to become stunted in their growth, by either their winter or summer keep. When designed for the market, they are disposed of at two, three, or four years old when not worked, according to circumstances. Where the intention is to work them, they should be trained as early as possible, and be brought into work at the age of two, or three years at the furthest. In Herefordshire the steers are brought into work at three years old, and are worked two years, mostly in yokes, though harness has lately been getting more common. In teams of six or eight they plough something less than an acre a day. But in the northern parts of Devonshire, where the breed is less admirably calculated for the purpose of labour, the oxen are yoked in at from two to three years old, being worked lightly; and at four years old they are brought into hard work, and from that age to six they are capable of performing a full day's labour. They there find, that if an ox is to be raised to the largest size, he must be worked: as, when kept till five or six years old without working, he will not reach the size he would have done if he had been inured to labour. This is the fixed opinion of the best informed farmers in that district. While under this system they should be well supported with dry food; such as oats in the straw, bean-meal, good hay, or cut chaff; and by the use of these in small proportions, with a few cabbages, turnips, carrots, or potatoes, they may be kept up in perfect condition. It is a practice that can never answer to the farmer, to let his working cattle-stock get low in condition, as the saving is a mere trifle in comparison to the disadvantage of bringing them into flesh afterwards.

The ox mostly reaches his full growth at six, but the largest-sized grow the longest. It is unprofitable to keep them longer than seven or eight years old.

In this district four are the usual number in a team, and occasi-

\* See Cow-keeping, in section the seventh, on the Cultivation of Grass Land.



usually two in cross ploughing; and with a double furrow plough six. Four plough an acre a day, and six fully two acres every day for six weeks. On arable farms of two hundred acres from eight to twelve oxen are sufficient; and three horses and ten oxen, or four horses and eight oxen, are equal to the labour of one of one hundred and fifty pounds a year, when nearly two thirds of the land are managed in a convertible method of husbandry, proper allowances being made for different circumstances. The method of managing them there is by means of the yoke and bows, in preference to the collar, as in such mountainous districts the power of the animals are in this way, or that by the head, more effectually brought into action. Lord Somerville has found this to be the case from actual trial, being convinced that the pole and the yoke form the true lever for the ox. Yoked in this manner, the labour is performed with great expedition and dispatch by these animals. Some advise the oxen not to be worked too hard, and in this view think six should be employed in a team, four working at a time, and two remaining alternately at rest. Whatever practice may be pursued in this respect, it is extremely necessary that the oxen be well shod before they are put to the work, as, where this is neglected, they soon get lame and useless. As there is considerable trouble and often danger in casting them in order to perform this operation, it is better to have a machine contrived so as to shoe them standing. Useful contrivances of this nature have been described.

The continued rise in the expense of horse-keep strongly shows, and at the same time enforces, the necessity and great benefit of making use of oxen in all cases where they can be employed to advantage.

In the fattening of oxen, or other sorts of neat cattle, various systems of management are practised in different cases, according to the particular circumstances and objects the farmer has in view, which have been already explained.\*

The age of neat cattle is shown by their mouths and horns. When turned two years old, the places of the calf-teeth are supplied by two new ones, and in every succeeding year two more are added until five, when the mouth is said to be full; this is not probably the case until six years old, as the two corner teeth are not fully protruded till that period.

In the horn, the first ring or circle does not take place till three years old, after which a fresh one is added every succeeding year, as long as the horn continues; but these rings are often effaced by the artifices of the jobbers and dealers in cattle, for the purpose of deceiving the purchasers.

Cattle are subject to a variety of diseases, which it is impossible to consider in any full or satisfactory manner in a work of this nature; but a few remedies that have been found beneficial in particular cases may be here mentioned in addition to those already noticed.

In cases of obstinate scourings, much advantage may be derived

\* See Grazing and Stall-feeding, in section on Cultivation of Grass Lands.



from a strong decoction of common chalk, hartshorn-shavings, and cassia, in the proportion of half a pound of the first to four ounces of the shavings and one ounce of the cassia; boiling them in two quarts of water to three pints, the last articles being put in towards the close of the operation: to this may be added, when cold, a pint of lime water and two drams of the tincture of opium. The whole being well mixed in a bottle, two or three good horn-fulls may be given twice or three times in the course of the day.

In the *Yellows*, which is a disease to which cows are very subject, advantage has been found from the use of soap, in the quantity of about one ounce, given once or twice a day, dissolved in a quart of the usual cordial drench, a little warm, keeping the animal confined, and using warm mashes and warm water occasionally.

Where there is a discharge of *bloody urine*, great relief has been derived from a strong decoction of oak or Peruvian bark, in which a small proportion of alum has been dissolved; two or more horn-fulls being administered twice or three times in the day.

The *Foul* is a disease in the feet of cattle, often proceeding from hard driving from a distance. After cleaning the parts, and wholly discharging the matter formed in the claws, they should be dressed with some mild digestive application, and be kept perfectly free from dirt, gravel, or other extraneous substances.

The *Garget* is a disease frequently affecting the glands of the udder with hard swellings. It often arises from the cows not being clean milked, and may be removed by anointing the part twice a day with a little ointment composed of camphor and blue ointment; half a dram or more of calomel being given in warm beer from a horn for three or more mornings if the disease be violent.

In fresh wounds, nothing further is necessary than keeping the parts clean and well covered from the air, previously drawing the skin over as much as possible.

*Sheep.*—The great value and importance of this animal in its flesh, fleece, and other products which it affords, is well known. As there are but few farms on which sheep cannot be kept with advantage in some intention or other, such as for the purposes of breeding, grazing, or the fattening of their lambs, it is obvious that they must constitute an object of the first consequence to the farmer. In many situations, by much the greatest part, and in others the whole of his profits depend upon them.

In disposition, the sheep is naturally tame, quiet, and inoffensive. It is possessed of less means of defence than most other animals, and at the same time more timid, which induces it to seek the society of the flock. The vale or pasture sheep are in general much more mild and gentle than those of the mountain or heath kinds. The sheep continues to increase in growth till three years old, when it is in common in the greatest perfection for the purpose of being fattened, but will be suitable for this use, as well as that of breeding, till five or six; but as a quick return is the great object of the grazier, they are mostly fattened at as early an age as possible.

The breeds and varieties of sheep that are scattered over the island are extremely numerous; but have been arranged and distinguished under different classes or breeds, by different farmers, in a variety of



methods, as from their having horns, or being without them, from the nature of their wool, and various other circumstances\*; but whatever may be the principle of distinction that is adopted, it is evident that they possess characteristic differences that may serve to discriminate them into distinct original breeds.

As in cattle-stock we have already seen that there is a certain form and connection of parts that bespeak the excellence or perfection of the breed, so in the sheep the same is the case, and the nearer any breed approaches to it, the more perfect or excellent it may be considered. In the ram, Mr. Culley has thus described it: "Head fine and small, nostrils wide and expanded, eyes prominent, rather bold or daring, ears thin, collar full from breast and shoulders, tapering gradually to where the neck and head join, which should be fine and graceful, being free from any coarse leather hanging down, shoulders broad and full, joining so easy to the collar forward and chine backward, as to leave no hollow in either place, mutton upon the arm or fore thigh quite to the knee, legs upright with clean fine bone equally clear from superfluous skin and coarse hairy wool, from the knee and hough downwards; breast broad and well formed, to keep fore legs at a proper wideness; girth or chest full and deep, and instead of a hollow behind the shoulders, that part by some called fore flank quite full; back and loins broad, flat and straight, from which the ribs must rise with a fine circular arch; belly straight; quarters long and full; mutton quite down to hough, which should neither stand in nor out; twist or junction of inside of thighs deep, wide and full, which with the broad breast, keep the fore-legs open and upright; thin pelt covered with fine, bright, soft wool." This is the model which, in so far as form is concerned, the breeder of this sort of stock is to aim at in the improvement of his sheep, having proper regard to the several other properties that have been already mentioned.

The *New Leicester* or *Disbly breed* is distinguished from the other long-woolled breeds by having fine lively eyes, clean heads without horns, straight broad flat backs, round or barrel-shaped bodies; fine

It has been remarked by Lord Somerville, in his "System of the Board of Agriculture," that "all the breeds of sheep in this kingdom may be arranged into two classes; those which shear the short, or clothing, and those which shear the long, or combing, wool."

The practical author of the *Present State of Husbandry in Great Britain* has arranged them under the three following general divisions:

- 1st. The Mountain Breed;
- 2d. The Short-woolled Breed; and,
- 3d. The Long-woolled Breed.

The first comprehending the several varieties that occupy the different mountainous and elevated situations in Wales, Westmorland, Cumberland, Yorkshire, the South, West, and North of Scotland, and in the Shetland Islands; the Cheviot-hills in the South of Scotland and North of England, and the forest and common sheep of the last country.

In the second are included those of Hereford, Dorset, Sussex, Norfolk, and some parts of Cumberland.

The last division embraces all those varieties that are dispersed over the more rich and fertile parts of England, and which are distinguished under the titles of the Durham or Teeswaters, the Lincoln-hires, the old and new Leicester-hires, &c.



small bones; thin pelts, and a disposition to make fat at an early age; to which may be added a superiority in the fineness of the grain and flavour of the mutton to that of other sheep of the large long-woolled kind. The weight per quarter in ewes three or four years old from 18lbs. to 26lbs.; in two years old wethers, from 20lbs. to 30lbs.; the length of wool from six to fourteen inches.

The advantage of this breed is supposed to consist in its producing a better profit to the farmer, in proportion to the quantity of food consumed, than most others; in being more perfectly formed, and consequently more disposed to fatten quickly; in containing a much larger proportion of meat on an equal weight of bone; in thriving well on such pastures as would not support other sorts of the same size; in being capable of being kept or fattened in larger proportions to the acre than other breeds of the same size of carcase; in the wool being more valuable, though less in quantity; in their being ready for the butcher in the early part of the spring instead of the autumn, by which there is a considerable saving in the summer's grass; and in the mutton, from the closeness of its texture, keeping longer than that of other equal sized breeds.

The principal objections to this improved breed have been made on the grounds of their fattening too much, and the mutton in consequence becoming less delicate in its flavour than in that of other breeds that require a greater length of time in the process; on the deficiency in the quantity of wool which they produce: and on their not being calculated for the fold. It is, however, unquestionably a valuable breed on particular sorts of pasture that are adapted to it, as is evident from its rapidly making its way into different districts.

The ewes in this breed are usually put to the ram so as to have lambs at two years old, when they mostly produce two lambs each

But Mr. Culley, in his "Observations on Live Stock," discriminates them with greater minuteness into several different breeds, in the following manner:

				Weight of Fleece.	Prices per lb. 1794.			Wethers per qr.	Years old when killed.
				lbs.	l.	s.	d.	lbs.	
1 Dishley	No horns	White face and legs	Combing wool	8	0	0	10	25	2
2 Lincoln	Do.	Do.	Do.	11	0	0	10	25	2
3 Teeswater	Do.	Do.	Do.	9	0	0	10	30	2
4 Dartmoor	Do.	Do.	Do.	9	0	0	8	30	2 $\frac{1}{2}$
5 Exmoor	Horned	Do.	Do.	6	0	0	8	16	2 $\frac{1}{2}$
6 Dorset	Do.	Do.	Carding wool	3 $\frac{1}{2}$	0	1	2	18	3 $\frac{1}{2}$
7 Hereford	No horns	Do.	Fine do.	2	0	2	9	14	4 $\frac{1}{2}$
8 South Down	Do.	Grey faces and legs	Do.	2 $\frac{1}{2}$	0	2	0	18	2
9 Norfolk	Horns	Black faces and legs	Do.	2	0	1	5	18	3 $\frac{1}{2}$
10 Heath	Do.	Do.	Coarse combing	3 $\frac{1}{2}$	0	0	6	15	4 $\frac{1}{2}$
11 Herdwick	No horns	Speckled do.	Carding	2	0	0	6	10	4 $\frac{1}{2}$
12 Cheviot	Do.	White faces and legs	Do.	3	0	0	11	16	4 $\frac{1}{2}$
13 Dun-faced	Do.	Dun faces and legs	Do.	1 $\frac{1}{2}$	0	3	0	7	4 $\frac{1}{2}$
14 Shetland	Do.	Colours various	Fine cottony	1 $\frac{1}{2}$	0	3	0	8	4 $\frac{1}{2}$
15 Romney Marsh	No horns	White faces and legs	Combing	8	0	0	10	25	2 $\frac{1}{2}$
16 Spanish	Horns	Do.	Carding	3 $\frac{1}{2}$	0	4	0		





*DISHLEY RAM*



*Neele sculp.*

*DISHLEY EWE*







in the proportion of about one-third of the whole, where they have been kept well; which should always be the case. When their forms are good they may be kept for the purpose of breeding till three or four years old.

The wethers may be killed so early as at two years old, with the greatest profit, as when kept longer they are apt to get unnecessarily fat.

The *Lincolnshire breed* is known by having no horns; white faces; long thin weak carcasses; thick rough white legs; bones large; pelts thick; slow feeding: mutton coarse grained, the weight per quarter in ewes 14lbs to 20lbs. in three years old wethers from 20lbs. to 30lbs.; the wool from 10 to 18 inches in length. This breed, as the name implies, is chiefly prevalent in Lincolnshire and other rich marsh or grazing land.

It is however, probably, capable of being kept with advantage, and made fat, only on the richest sorts of grazing pastures. But in these cases it may be kept with more profit than the above breed, to three years old. The weight of mutton which the sheep afford is great: but the flesh coarse, with a large proportion of bone. The chief excellence is in the large quantity of wool which they afford, which pays for their being kept longer than other breeds before they are made fat. In its improved state it is, however, a breed much less profitable to the farmer than those that feed quicker, except in the case of such rich pastures as have been mentioned.

In the *Tees-water breed* the legs are longer, finer boned, and support a thicker and more firm and heavy carcass than the Lincolnshire; the sheep are much wider on the backs and sides; and afford a fatter and a finer grained mutton. The weight per quarter in two-years old wethers is from 25 to 35lbs. and in particular instances to 55lbs. or more. The wool is shorter and less heavy than in the preceding breed.

This is the largest breed of sheep in the island, and is the most prevalent in the fine fertile inclosed lands on the borders of the Tees in Yorkshire.

In this breed, which is probably from the same stock as the above, more attention has been paid to size than wool. It is only calculated for warm inclosed rich pastures, where they are kept in small lots, and well supported with food in severe winters. They produce a large weight of mutton; but then, from their requiring so much longer time and richer keep, and being admitted in so much smaller proportion on the acre, they are probably not upon the whole so profitable, even in situations where they can be kept with the most chance of success, as the smaller more quick feeding breeds.

The ewes of this breed are, however, in general, very prolific, mostly bringing two and frequently three lambs each. And in some cases a greater number have been produced.

Improvements have been made in this breed by crossing with the new Leicesters. It is a breed that is, however, very seldom found pure.

This is a sort of sheep that has been greatly neglected, but which,



if judiciously improved by crossing, it is supposed would answer and pay well in districts proper for its support. It is suggested by Mr. Parkinson, in the Corrected Report of the State of Agriculture in the West Riding of Yorkshire, that an useful kind is capable of being raised by crossing the ewes of this breed with Dishley rams, in the management of an expert breeder. Indeed, by the use of these, and those of the Northumberland kind, the quality of the wool and the mutton has not only been greatly improved, but the quantity of bone and offal much lessened; and, at the same time, the fattening property considerably increased; they becoming fatter at two years old than the others are at three. The wethers of this improved sort generally sell unshorn at two years old, from 45s. to 55s. a piece, and weigh from 24lbs. to 30lbs. the quarter.

The *Romney-Marsh breed* of sheep is without horns; white faces and legs; rather long in the legs; good size; body rather long, but well barrel shaped; bones rather large. Weight per quarter in fat wethers at two years old, from 22lbs. to 28lbs. Wool fine, long, and of a delicate white colour.

This breed has the quality of arriving at the state of fatness at an early age, as well as that of producing a large fleece of fine long combing wool, which renders it highly valuable. But from the size and the circumstance of the heaviness of the coat, it is only capable of being kept and fattened on the rich kinds of pasture: in such situations it is, however, an excellent breed.

On the rich marsh lands from Hastings to Rye, the graziers find this breed much more advantageous than the South Down; the marsh wethers fattening more quickly. The wool afforded by this breed of sheep is mostly large in quantity; in marsh fat wethers averaging six pounds, and in breeding ewes five pounds, but not equal in quality to the wool clipped from shearlings. A proof of the great value of this breed of sheep, as well as of the land on which they are fed, is seen in the manner of stocking, which in *tags* is from four to seven per acre, in fattening wethers from six to eight, in barrens from two to three, and in couples three.

The *Dartmore or Devonshire Natt breed* is chiefly distinguished by having no horns; white faces and legs, thick necks, backs narrow, and back bones high; sides good; legs short, and bones large. Weight of ewes on the average about 20 pounds per quarter; in wethers at two years and a half old 30lbs. Length of wool much the same as in the preceding breed. It is a breed which is predominant in some parts of Devonshire, as the name sufficiently indicates.

This breed is said to have received considerable improvement by being crossed with the new Leicesters.

The *Exmoor breed* of sheep is characterised by having horns, and white faces and legs; by being very delicate in the bone, neck and head; by the form of the carcase being indifferent; narrow and flat-sided. Weight per quarter in wethers at two years and a half old from 15lbs. to 18lbs. and the weight of wool much less than in the preceding breed. This small breed of long-woolled sheep is principally produced on, or in the neighbourhood of the moor from



*Mountain Sheep*



*Wild sheep, Strand.*







*Common Sheep.*



*After a study, Skene.*











(2) Harford. (V. 17.)



Head or. Stroud.



which it takes its name, which is in the northern extremity of the above county.

This sort of sheep are frequently kept two or three years merely for the annual profit of their fleeces, which often do not exceed more than four pounds in weight. But from their being kept upon very bare and indifferent pastures while young, they are supposed by many sheep-farmers to be a very profitable sort of stock.

The *Dorsetshire breed* is known by its mostly having horns; white faces; long small white legs; by the carcase being rather long and thin; and by the mutton being fine-grained and of good flavour. Weight per quarter in wethers at three years and a half old from 16lbs. to 20lbs. Wool fine and short.

This breed has the peculiar property of producing lambs at any period in the season, even so early as September and October, so as to suit the purposes of the lamb suckler.

The Wiltshire sheep are considered by Mr. Culley as a variety of this breed, which have acquired an increase in weight. And other varieties of it are met with in several other districts.

It is a breed that has been found to answer well in some of the midland districts, and, from its close make, to be equally advantageous with almost any other. It is, however, supposed capable of improvement by being crossed with rams of a larger size.

The *Herefordshire breed* of sheep is known by the want of horns, and having white legs and faces; by being small in size; and the wool growing close to the eyes; by the carcase being pretty well formed; and by the excellence of the mutton. Weight per quarter from 10lbs. to 18lbs. Wool fine and short; the lean poor-fed sheep producing the finest. The true breed of this sort of sheep is frequently denominated *Ryelands*.

This breed is found to be remarkably patient of hunger; but in its management requires coting in the winter season, and being fed with hay or peas-halm. In some cases they are indeed housed all the year round in the night-time. The cots are low covered buildings, proportioned to the extent of the flocks. They are said to fatten the best at four years old. The *Archenfield* or true Herefordshire breed produces the finest wool. And Mr. Knight remarks that the disposition of sheep to fatten in the north-west part of that district is in proportion to the fineness of the wool; but he is not certain of its being so in this breed. But it seems to him that where the wool is close and fine, there are many advantages; less nourishment is drawn from the body in its support than in the contrary case. The long coarse-woolled fleece admits the rain more freely, and by dividing on the back lets it down to the skin. It also takes in a larger weight of water, which must more inconvenience the animal already heavily loaded. The fine close fleece of this breed admits the water with difficulty, even when immersed in it, in washing, and is never wet through by rain. On account of the closeness of the texture, it only lodges on the outside, and is easily removed by the animal shaking itself. Besides, a fleece of this kind is much more warm and light. On these grounds it is supposed, that no breed of



sheep in the island is capable of subsisting on so small a proportion of food.

By crossing this breed with the Dishley an useful kind of sheep has been produced, both the wool and the carcase being increased in weight, but much injured with respect to fineness.

The *South-Down breed* is distinguished by having no horns; grey faces and legs; fine bones; long small necks; and by being rather low before, high on the shoulder, and light in the fore-quarter; sides good; loin tolerably broad, back-bone rather high; thigh full; twist good; mutton fine in grain and well flavoured.—Wool short, very close and fine; in length of staple from two to three inches. Weight per quarter in wethers at two years old 18lbs. This breed is predominant on the dry chalky downs in Sussex. It has been lately much impaired both in carcase and wool; and for the short less fertile pastures is an excellent sort. The sheep are hardy, and disposed to fatten quickly. Mr. Ellman, of Glynd, is in possession of a very superior stock of this valuable breed. Where the ewes are full kept, they frequently produce twin lambs, nearly in the proportion of one-third of the whole, which are, when dropped, well woolled. The wethers are capable of being disposed of at an early age, being seldom kept longer than two years old, and often fed at eighteen months.

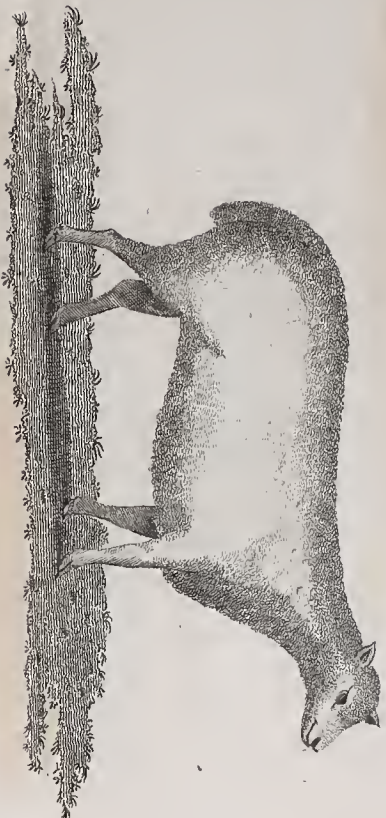
The ewes are usually kept till between four and five, and found to answer well to the graziers in the neighbourhood, as well as the farmers in Norfolk and the adjoining counties, in the place of home-bred sheep, as being more expeditious feeders, and equally adapted for the purpose of the fold.

It is a breed of sheep, which from the compactness of their form, and their legs being shorter, considerably outweigh both the Dorset and Norfolk breeds in proportion to the size of the carcase, being heavy in a small compass. Their hardiness is estimated according to the darkness of the colour in the face and legs; but as there is inconvenience in the produce on this account, from the wool, especially about the head and neck, becoming spotted with black, and thereby thrown aside by the stapler, as only of half the full value, a middle degree of colour may be the best. As an open country breed, they are sufficiently gentle and tractable. They are capable of travelling well, and of resisting the effects of exposure to cold. The wool is scarcely, if at all, inferior in fineness to that of the Herefordshire kind; as the practice of sorting, which is common in that district, is not in use on the Downs. The merit of this breed is such as to have induced the sheep-farmers in various districts to introduce them in preference to the above breeds, and on comparative trials, they have been found to possess a superiority.

They have been found to consume less food in proportion to weight than the Norfolks, yet keeping in better order. Young sheep produce the best lambs, the *crones* are of course constantly sold at four or five years old, and if it were done earlier it is supposed it would be more profitable.

On Cannock Heath in Staffordshire, there is a sort of sheep that





*South Down ewe.*

*South Down EWE.  
Bred by Mr. Edmund Gifford, Ingleton.*

*South Down ewe.*



*South Down ram.*

*South Down RAM, bred by Mr. Edmund Gifford, Ingleton.*

*South Down ewe.*







has much resemblance to this, and is believed to have originated from the same breed. It has lately been much improved in the form, thickness, and weight of the carcase, as well as the fineness of the wool, by crossing with rams of the Herefordshire breed.

In the *Norfolk breed* of sheep the face is black ; horns large and spiral ; carcase long, small, weak, and thin ; narrow chine ; large bones ; very long black or grey legs ; mutton fine grained and high flavoured, but does not keep well in hot seasons. Weight per quarter from 16lbs. to 20lbs. Wool short and fine. This breed is chiefly prevalent in Norfolk and Suffolk, where folding is much the practice, as they have the property of travelling well. In disposition they are given to be restless.

This sort of sheep, as possessing few valuable properties in addition to that of their standing the fold well, and as requiring much expense in their winter keep, an acre of turnips being the usual allowance for half a dozen besides hay, have lately given way to the preceding breed, which is supposed by some to be hardier, less nice in their food, sooner ready for the fold, and more quiet.

The circumstances most favourable are those of their being the native stock of the district ; their bearing the fold better than others in that cold climate ; their travelling well to distant markets ; their mutton being good and in high estimation in Smithfield ; and the produce in wool, though small, of a good quality. The South-Down breed has, however, been found to answer so well in the districts where this sort of sheep is predominant, that some experienced sheep-farmers have introduced them with considerable benefit.

The *Heath breed* of sheep is known by having large spiral horns ; black faces and legs ; a fierce wild-looking eye ; short firm carcase ; mutton excellent in grain and flavour. Weight per quarter from 12lbs. to 16lbs. Wool open, coarse, and shagged. This is an extremely active and hardy breed, which is first met with in the more north-western parts of Yorkshire, whence it has extended itself over the extensive mountainous tract of country on the borders of the Irish Sea, which stretches from Lancashire to Fort William in the Western Highlands of Scotland. The great objection to it is the coarseness of the fleece and the wildness. They are mostly fattened about the third or fourth year, at which age they are found to answer the best.

The *Herdwick breed* is distinguished by having no horns ; by the face and legs being speckled, the larger the portion of white, with fewer black spots, the purer the breed : legs fine, small and clean. Weight per quarter in the ewes from 6lbs. to 8lbs. ; in the wethers at four years and a half old from 9lbs. to 12lbs. Wool short, thick and matted in the fleece.

This breed is peculiar to the elevated mountainous tract of country at the head of the rivers Esk and Duddon in Cumberland, where they are let to herds, whence the name. They are said to possess the property of being extremely hardy in constitution.

This small breed is so extremely hardy, as to support itself on the rocky bare mountains with the trifling support of a little hay in the winter season ; scratching down to the heath during the snows.



The ewes, from the nature of the climate, produce their lambs late ; but which, when dropped, are well woolled. They are generally kept as long as they produce lambs.

The wether stock is mostly disposed of from the mountains, without being put in the pastures, at from four to five years old.

The fleece in this breed is finer than in that of the preceding ; but coarser than any of the short-woolled breeds. They stand in need of a cross with some of the finer-woolled breeds.

The *Cheviot breed* of sheep is known by the want of horns ; by the face and legs being mostly white, and the eyes lively and prominent ; the body long ; little depth in the breast ; narrow there and on the chine ; clean, fine, small-boned legs, and thin pelts. The weight per quarter, when fat, from 12lbs. to 18lbs. ; wool partly fine and partly coarse.

It is said to be a valuable breed of mountain-sheep, where the herbage is chiefly of the natural grass kind ; which is the case in the situations where they are found the most prevalent, and from which they have obtained their name. It has undergone much improvement within these few years in respect to its form and other qualities. This breed has been lately introduced into the most northern districts ; and from its hardiness, its affording a portion of fine wool, and being quick in fattening, it may answer well in such situations.

The practice of milking the ewes of this breed for the purpose of making cheese is found to be prejudicial to the animals, and has of course been much left off by the best sheep-farmers.

The *Dun-faced breed* has no horns ; the face, as the name implies, is in common of a dun tawny colour ; the size small ; tail short ; mutton fine. Weight often only 6lbs. or 7lbs. the quarter. Wool variously-streaked and blended with different colours, some of which is very fine. Mr. Culley supposes this to partake of the Spanish breed. It is not so hardy as the preceding.

The *Shetland breed* is small, and mostly without horns ; but what more particularly distinguishes it from other breeds is, the uncommon smallness and shortness of the tail. Weight per quarter from 7lbs. to 10lbs. Wool very fine, and of various colours.

This is a very hardy breed, but too wild in its disposition to be confined in inclosed pastures.

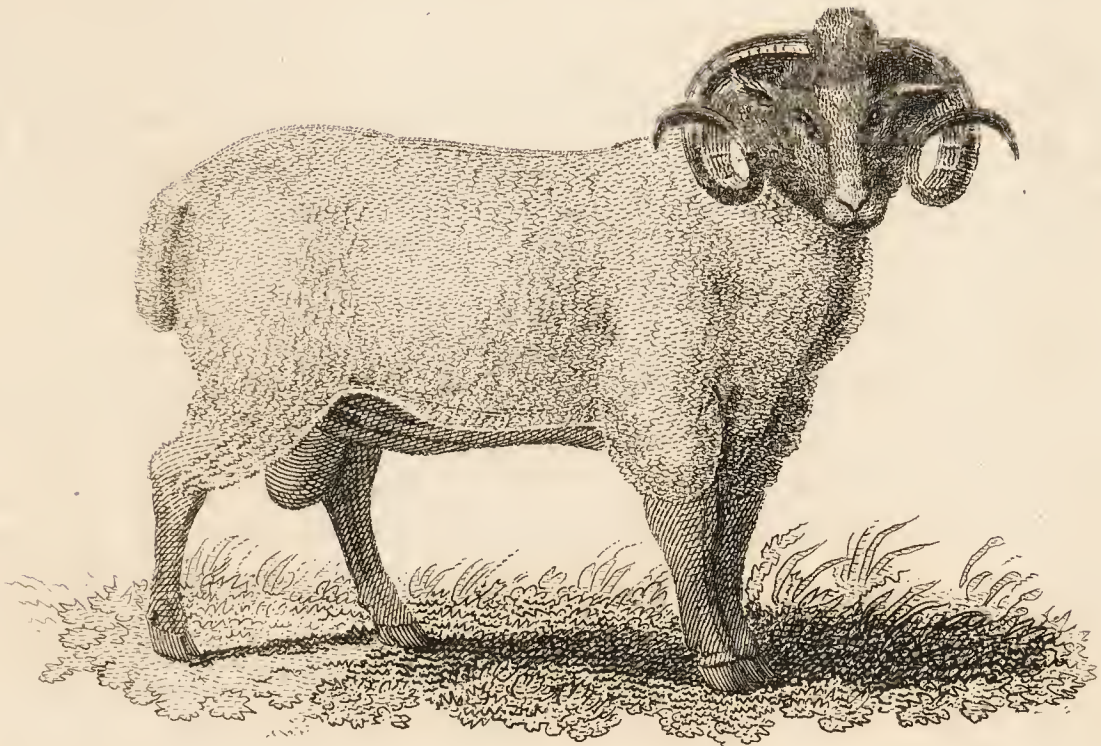
In the *Merino* or *Spanish breed* of sheep the males have horns, but the females are mostly without ; white faces and legs ; the body not very perfect in shape ; rather long in the legs ; fine in the bone ; a degree of throatiness or production of loose pendulous skin under the neck ; and the pelt fine and clear. Weight, when tolerably fat, per quarter, in the rams about 17lbs. ; in the ewes 11lbs. Wool very fine. This breed is asserted to be tolerably hardy, and to possess a disposition to fatten readily.

Mr. Knight observes that the produce of the cross with this breed and the Archen field or Herefordshire sort are very ugly, and, he is informed, subject to the footrot.

In these breeds of sheep, we have seen that there are evidently differences in their sizes, forms, flesh, wool, and other properties, that admirably adapt them for different sorts of pastures, situations,



*A MERINO RAM.*



*A MERINO EWE.*



*Neale sc. Strand.*







and uses. The large long-woolled breeds, from their being more slow, heavy and tame in their dispositions than most other kinds, are in general the most proper for the rich inclosed pasture districts: the breed which possess greater length in the legs, more activity in walking, and a less burthen of wool, are suited to the more elevated lands, such as the *downs*, *moors*, and *heaths*, in different parts of the island, where the pasturage is less fertile and luxuriant: and the small, light-carcased, hardy breeds, are most adapted to the exposed mountainous situations, where the food is more sparing, and obtained with greater difficulty.

Mr. Marshall, in the Rural Economy of the Midland Counties, has indeed observed, that a very long-woolled breed of sheep, such as the old Lincolnshire or Teeswater, is necessary for the richest sound grass lands, and the finest worsted manufactures; and another, as the new Leicester, for the less fertile grass lands as well as the rich inclosed arable lands, where the practice of folding is not in use; for the purpose of the coarser sorts of worsteds, stockings, baize, coarse cloths, blankets, carpets, and other similar articles: a middle-woolled breed, such as the Wiltshire, the Norfolk, or the South Down, for the well-soiled arable lands, where the fold is employed, for the making of cloths of the narrow medium kinds; a very fine-woolled breed, such as the Herefordshire, Ryeland, for the purpose of the finest cloths: and the Shropshire, or some of the more hardy breeds, for the heathy mountainous situations.

It is therefore necessary, in introducing new breeds of sheep, for the farmer to attentively consider the nature and situation of his pasture, and cautiously avoid employing larger or finer breeds than can be properly supported. Upon the proper regulation of this point much of his success in the improvement of his sheep-stock will depend. And where the bettering the form or improving the quality of the wool are in contemplation, this is to be particularly regarded, while such improvements are attempted by judicious crossing with proper breeds for the purpose, on the principles that have been already explained.

It seems evident from a variety of facts that have been lately presented to the notice of the farmer, that wool of the finest quality may be produced in this country by means of *Spanish sheep*, and their being judiciously crossed with our own fine-woolled breeds; a circumstance of the greatest national importance, as affording a probable means of rendering us independent of the foreign supply of this expensive but indispensable article. Too much attention cannot therefore be bestowed by the breeding sheep-farmer, in promoting this sort of improvement, wherever the nature of his land will admit of it; which may be the case, in most situations, where the short-woolled breeds of sheep can be properly kept, or probably on more than one half of the pasture-lands of the kingdom. There is one inducement to this, which is that of its not interfering with the production of the most valuable sort of mutton, a point to which the sheep-breeders of this country have till lately been particularly attentive, almost without regarding the quality of the wools; as it has been found that the quality of the flesh in the different divisions of



sheep inclines to the nature of the wool, the short-woolled sheep being close in the grain of their flesh, of course heavy in the scale, and in the taste high flavoured; while the polled long-woolled sort are more open and loose in this respect, larger in size, and the mutton more coarse, and in general less saleable.

*Management of sheep.*—In the management of sheep different systems are pursued, according to the nature of the farms on which they are kept, and the methods of husbandry that are practised; but whatever these may be, it is a principal object with the best sheep-managers to preserve them in as good condition as possible at all seasons of the year. This is particularly the case with the pasture kinds of sheep. In order to accomplish it in the best manner, it is useful to divide them into different parcels in respect to their ages and sorts, as by such means they may be kept with more convenience and advantage than in large flocks together under a mixture of various kinds. In this mode there will be less waste of food, and the animals at the same time thrive better, and the pastures be fed with more ease and facility. The benefit of this management has been fully experienced in many of the northern districts, where they separate the sheep-stock into lambs, yearlings, wethers, and breeding ewes. It is probable, too, that in this practice a much larger proportion of stock may not only be kept, but the sheep be preserved in a more thriving and healthy state.

It has been the common practice, except in particular instances, to leave the ewes for the purpose of breeding, without any selection; but it is obvious, that where good sheep-stock are desired, much care and attention should be bestowed in choosing such as are the most perfect, and possess in the highest degree those properties which are wanted, let the breed or variety be what it may; as it is only by adhering to this principle that success can be ensured.

This business should therefore be carefully performed at the time they are turned to the ram, if it has not been done before. And it is equally necessary that a similar degree of attention should be paid to the selecting of the rams, and the adapting of them to the ewes. It is remarked by Mr. Young, in his *Farmer's Calendar*, that the late Duke of Bedford, in attending to this point, had every ram, with the lambs got by him the preceding year, put in distinct pens, that he might not only examine them, but their progeny, previous to his deciding "what ewes to draw off for him." This method is highly judicious, and deserving of imitation by the less intelligent sheep-farmer. "Such attention," it is added, "united with a careful selection of the best lambs, must keep a stock in a state of progressive improvement, proportioned to the accuracy of judgment, eye, and hand, of the farmer who practises it."

The most advantageous and proper age for ewes taking the ram in the different breeds has not been fully shewn; but from a year to a year and a half old may be sufficient, according to the forwardness of the breed and the goodness of the keep.

The usual time of having the rams admitted is about the beginning of October; except in the Dorsetshire ewes, where the intention is suckling for house-lamb, in which case it should be much earlier,



in order that the lambs may be sufficiently forward. But, by being kept very well, any of the breeds will take the ram at a much earlier period. Where the rams are young, the number of ewes should seldom exceed sixty for each ram; but in older rams a greater number may be admitted without inconvenience; but letting them have too many should be cautiously avoided, as by such means the farmer may sustain great loss in the number of the lambs.

The ewe goes with lamb about the space of five months, of course the common lambing-season is March, or the early part of the succeeding month; but in many of the more southern districts, where sheep husbandry is carried on to a considerable extent, some parts of the ewe-stock are put to the rams at much earlier periods, so as to lamb a month or six weeks sooner; a practice which is attended with much profit and advantage in many situations where early grass-lamb is in great demand. It is usual for the rams to remain with the ewes for a month or six weeks, and in some cases longer, in order to complete the business of impregnation, which in some districts is ascertained by smearing the *fore-bows* of the rams with reddle, ochre, or some similar substance that has the property of marking.

During the time the ewes are in lamb, they should be kept in the pastures, and as free from disturbance as possible, and be carefully attended to, in order to prevent accidents which are liable to take place at this time, such as those of their being cast in the furrows without the means of getting up again. In case any of the ewes should slip their lambs they should be immediately removed from the flock. They require, as is the case with all other sorts of live stock in similar circumstances, to be kept as well as the nature of the farm will admit, in order that there may be less loss at lambing-time, from the ewes being stronger, and the lambs more healthy, and better capable of contending with the state of the season at which they may be dropped. Where pastures or other sorts of good grass-lands cannot be reserved for their support, turnips or other kinds of green food should be provided for the purpose, and given them in a suitable manner; but where it can be done, it is always better to leave this sort of food untouched till about the period of lambing, when it should be regularly supplied in proportion to the necessity there may be. The ewes at this time also demand considerable care being taken to see that they are put upon a dry sheltered pasture free from disturbance, and that neither they or their lambs sustain injury from the severity of the season. Whenever this is the case, they should be carefully removed into a proper degree of warmth and shelter until restored. It is likewise a necessary as well as useful practice, as they lamb down, to take them and their lambs away from the common stock, putting them into a piece of turnips or fresh dry pasture where there is shelter when necessary, as by this means much fewer lambs will be lost.

By the proper supply of turnips at this period, the milk of the ewes is much increased, and the growth of the lambs greatly promoted: which is of much consequence, as when they are stinted at this early period they never turn out so well afterwards.



It has been observed, that “in some parts of the kingdom, the best farmers give their ewes and lambs bran and oats, or oil-cake, in troughs, while they are feeding on turnips;” but it is remarked that “it must be a good breed for such a practice to repay.” When the weather is extremely wet or stormy, or there is much snow upon the ground, the ewes and lambs should have hay given them in baits as may be necessary. This is best done in covered moveable racks, a portion being given fresh every day. If shelter can be provided with convenience, it will always be of much benefit to the sheep. The practice of letting them to the hay-stacks, which is common with some farmers, is slovenly and wasteful, and which, though it may afford a degree of shelter, should never be attempted where the other methods can be had recourse to. It has been suggested as an excellent method, though not essentially necessary, to allow the sheep, whether the weather be bad or not, a small proportion of hay daily while at turnips. By this careful management, and the use of stubble turnips, when necessary, the ewe and lamb stock may be well supported through the severity of the winter, and be brought on in the best possible condition until the turnips are finished in March, which should always be the case, when the preserved grass or rouen may be ready to receive them, which is considered by some as the most to be depended upon through this and the following month, which, with the first week in May, is the most difficult period of the year to the stock-farmer. On dry meadows and pastures it is invaluable in this view, though at first sight it may have an unpromising appearance from the covering of decayed autumnal grass that is upon it; but which, when removed, presents a new growth of fresh green grass, five or six inches in height, brought up by the shelter and warmth afforded by the covering of old grass. This is found to agree remarkably well with the sheep, as they consume both together, having, as it were, both hay and grass in the same bite.—It is supposed by the same correct agriculturist, to be impossible “to keep a full stock of sheep so cheaply in April by any other method as by this. Tolerable rouen will carry ten ewes an acre with their lambs through the whole month. Such rouen may be worth in autumn ten or twelve shillings an acre; in April it is worth thirty or forty shillings; and if it be a backward season, a farmer that has it would not be tempted to sell it for much more.” But in the support of his sheep and lamb stock, if the farmer be provided with a sufficient extent of watered meadow, he may fully depend upon that, without any other provision for this period.

But in cases where these cannot be depended on for the support of the sheep stock at this difficult season, the improved practice is, instead of depending on turnips and hay with rye sown for the purpose, the young wheats, and the run of the pastures, to let the turnips continue so as that their shoots may become an object of sheep-food, and to have annually a portion of tolerable good land, sufficient to the extent of the flock, under rye grass and clover, so as to be ready in the spring to take the sheep from turnips, and support them till the period of turning upon the pastures. It is remarked that “this conduct is an improvement on the other, as it gets rid of these great



evils : depending on rye, which is soon eaten ; feeding on wheat, which is pernicious to the crop ; and turning too soon into the general pastures. But at the same time that it effects this advantage it is open to some objections, which make further improvement necessary. Keeping the turnips long in the spring is very bad husbandry ; it damages greatly the barley crop, both in robbing the land and preventing it from being sown in proper time : nor is the food of great consequence ; for many acres of turnip-tops are requisite, the number of which must be in proportion to the stock of sheep ; and as to the roots, they grow so sticky and hard after the tops are at all advanced, that their value is trifling. With respect to rye grass, the clover mixed with it is seldom above three inches high at this season ; and a great breadth of ground to a given stock must be assigned to keep the sheep through April. The number of acres of that young growth necessary to keep a hundred sheep and lambs is surprising ; so that these farmers, although they manage to spring-feed more sheep than the worst of their brethren, yet effect it at a great expense, and at last not in any degree comparable to what might be done. A turnip should never be seen on the ground after March. For in the month of April the farmer should have a field of cabbages ready, which, yielding a great produce on a small breadth of ground, reduces the evil of a late spring sowing ; and, if he manage as he ought, totally excludes it. The turnip-cabbage, and ruta бага will last as long as wanted ; and, though it runs to seed, yet the bulb will not be sticky. The green boorcole may be fed off several times. It is impenetrable to frost, and will make shoots in the winter."

By these means, the sheep and lambs may be continued in good and healthy condition, which is of great consequence to the stock, till the time of turning upon the pastures, when they should be separated, where the farms are inclosed into suitable divisions, in proportion to the quantity that each pasture which they are to occupy can support, care being taken not to over-stock the fields, though hard stocking in some cases may be useful. By some managers they are put upon the best pastures of the farm, while others let them have those of the inferior kinds. Each method may have its advantage under different circumstances ; but the main object, that of having the stock preserved in good condition, is never to be lost sight of. In keeping sheep on inclosed pastures, particularly where the lands are much occupied with wood, constant care is necessary in order to guard against the mischief of the fly, as its effects are often irremediable in the course of a very short time in such situations, if not attended to, in hot seasons.

The weaning of the lambs is a business that should be attended to some time in the course of July, but it is accomplished more early in some districts than others. In order to effect this in the best and most advantageous manner, a proper reserve of some fresh pasture grass, where there may be a good bite for the lambs to feed upon, should be made. It is of much consequence that an ample provision of this nature be had, in order that the growth of this young stock may not suffer any check on being taken from the mother. Some



advise clover in blossom as the most forcing sort of food in this intention. And saintfoin rouen is highly valuable for the same purpose. The ewes should be removed to such distant pastures or other places as that they cannot be heard by the lambs, and thereby cause them to be disturbed in their feeding. And where the ewes sustain any inconvenience from their milk, it should be drawn once or twice, as by this means disease may be prevented. After the lambs have been removed, the ewes are returned to the situations destined for their summer support.

As it is necessary in the common management of sheep-stocks to remove a certain number of the crones or old ewes annually, and replace them by the best lambs, in order to keep them up in the greatest perfection, it is of considerable importance to have the business performed in a proper manner. In most of the sheep-districts in the southern parts of the kingdom, this selection or setting of lamb-stock is usually made about the month of August, when the fairs for the sale of lambs mostly take place. And as the whole are then collected for drawing into different lots, it may be a very suitable period for selecting those that are to supply such deficiencies in the breeding stocks. It is observed by Mr. Young, in his excellent *Calendar of Husbandry*, that “in making this selection the farmer or his shepherd usually (whatever the breed may be) rejects all that manifest any departure from certain signs of the true breed; thus, in a Norfolk flock, a white leg, and a face not of a hue sufficiently dark, would be excluded, however well formed; in the same manner a white face, on the South Downs; in Wiltshire, a black face, would be an exclusion, or a horn that does not fall back; in Dorsetshire, a horn that does not project, &c. &c.” And where the produce is annually sold lean, there is reason in all this: for customers who have been used to, and prefer certain breeds, as having paid them well, are apt to be fastidious when they purchase. Some farmers in this selection look chiefly at size, always keeping the largest frames; but this is probably erroneous, unless they keep very high. It connects with a question by no means ascertained, whether sheep do or do not eat a quantity of food proportioned to their weight. In general, it is a safer rule to choose a well-formed lamb, or that indicates the probability of making a well-formed ewe, rather than to select for size. The attention that is to be paid to wool, in the breeds that produce the carding sort, will depend on the price to be received: if the farmer lives in a district where the price of the year is given equally to all flocks, there is little encouragement to lessen quantity for the sake of quality; retaining however in idea the fact, that both are attainable, that it is very common to see coarse *breeched* sheep with light fleeces, and those of a fine quality heavy in weight. The Spanish fleeces, which are finer than any other, are heavier than those of our finest-woolled sheep. With combing wool the importance of the fleece depends still more on price; we have seen it at 8s. a tod; and it has lately been 36s. Quality is of very little consequence indeed, compared with quantity; and when wool sells high, no prudent breeder will set his stock without being governed considerably by this object.



And as this is not only the proper period of filling up the deficiencies in the ewe-stock, but also for increasing or diminishing the quantity of stock, by reserving a larger or smaller number than that of the old sheep which are disposed of, it is a matter that demands particular attention. The following are useful directions: “On a farm with a given stationary sheep-walk, it is probably regulated by circumstances that rarely change; but, on inclosed farms, where the sheep are supported by fields alternately in grass and tillage, variations may easily be supposed, and the question of hard or light stocking, that is, of close feeding or a head of grass, then comes in to decide the number kept. If the produce or profit per head is looked to, the conduct to be pursued is evidently to stock lightly; but if the return is looked for in corn from fields laid down for refreshment by rest, then close feeding is a very material point, and the number kept will depend on it. With all the grasses, &c. that do not decline from age, the more sheep you keep the more you may keep, and the more corn you will reap when such are ploughed; a circumstance too important to be forgotten. But the young farmer will remember, that upon this system he must not have a *show* flock, or let the vanity of a farm have the least influence with him: if in this way he will have something to talk of, a score or two of pampered favourites, the fewer the better, for they may cost him more than they are worth.”

After this business has been properly executed, the ewe and wether lambs which remain are usually sent to the neighbouring lamb-fairs to be disposed of. But where the fairs for this purpose happen later than this period, as in the beginning or latter end of September, as is the case in some places, Mr. Young advises that “great care be taken to keep them in forcing food, as in spring-tares early-sown rape, good grass of the right degree of bite, &c. &c. in order to promote their growth and increase their value; but to sell in August is more beneficial.”

In the down and mountain sheep there is some difference in the management from that of those on the inclosed lands, though the same attention in the selecting and choosing of the breeding and ram stock is now mostly practised with the better and more enlightened sheep-farmers in such districts.

In the former situations they are perfectly aware that, besides the improvement of their tillage lands, their sheep can be rendered of considerably more value; a circumstance which has had the happiest effects in promoting improvements in this department of husbandry. The chief difference in the method of keeping them, is in their being turned upon the downs, heaths, or commons, as early as possible in the spring season, as about the middle of April, and kept there till the beginning of autumn, as in October; the short sweet nutritious herbage in these situations affording them a supply of food sufficient to keep them in tolerable order; but when this keep begins to decline, the farmers have recourse to other sorts of food, the sheep being usually folded on turnips or cole, on which they are continued during the winter until they are expended, when they are chiefly fed with hay, stacked for the purpose on the downs or other places,



till there is again a sufficient bite of grass. In these cases the practice of folding is mostly in use throughout the year; which during the summer and autumn is mostly on the lands under preparation for wheat-crops, but in the winter occasionally on the stubbles, though more generally on the downs and pasture; and in the spring on the grounds that are destined for the barley crops.

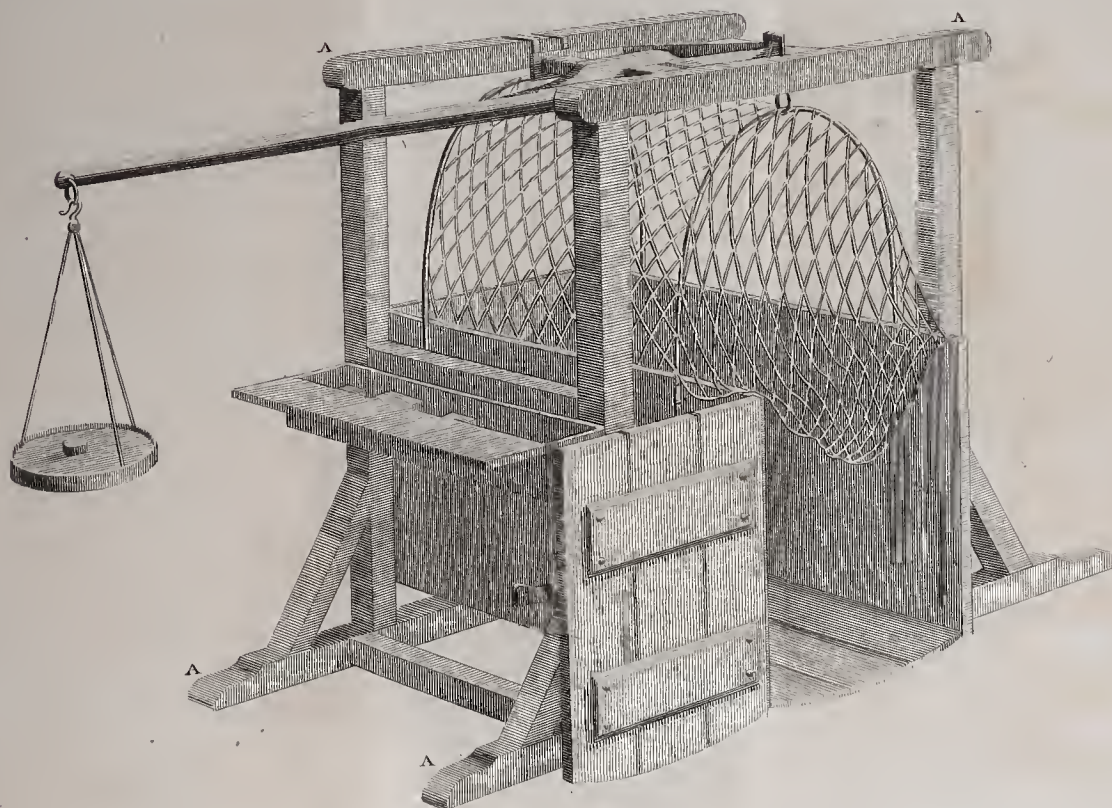
In some of the more elevated and hilly districts in the northern parts of England, where sheep-husbandry is conducted on an extensive scale, the sheep on being divided, under the care of different shepherds, into old sheep, such as wethers and two-years old, and breeding and young sheep, the former are put upon the more elevated and exposed pastures, and the latter on those that are more fertile and sheltered, being well supported in the winter with turnips and hay.

There is another inferior sort of management in those situations, which is that of permitting the flocks to range over the hills and commons during the summer season, mostly without being under the command of any shepherd. About the close of this season, or on the approach of winter, they are collected together, and brought home, in order to undergo the operation of *smearing* or *salving*, with a mixture of butter and tar, a practice which is common in these districts, though it does not prevail, we believe, in the sheep-husbandry of any of the more southern parts of the island. After this work has been performed, the old stock-sheep are returned to their former situation, and, in some cases, the hogs and other young sheep with them. But in other cases a better management is pursued; in some instances, where the nature of the farms will admit of it, these last sorts being wintered in the inclosed pasture grounds that are near to the houses; and in other places, what are termed the home-grounds, whether open or inclosed, are purposely preserved or saved during the summer season, in order to admit the whole stock to be supported on them in the winter. When these are not sufficient for this use, others at a distance are frequently provided. In severe seasons, some hay or straw is likewise given daily.

In the sheep-districts in the most northern parts of the kingdom, a still less eligible management is in use: the flocks are in common left to provide for themselves even in the most severe and inclement seasons, when the bleak tracts on which they live are covered deeply with snow. In these cases the sheep have their chief dependence for subsistence on their own habits, which lead them to remove the snow by their feet with great facility till they reach the heath or withered herbage. When the snow is falling or blown by a storm, the shepherds, however, drive the flocks without intermission, round the top of a hill, in a circle, in order to keep them from lowering and being drifted up or smothered. It is likewise the practice in some countries to erect circular folds on the tops of low hills for the same purpose: and when the heath is all covered, they sometimes harrow the snow in order to bring up the heath; for which use the harrows should only have few but long teeth. Some have recourse to feeding with hay or unthreshed oats in handfuls upon the snow. But as these only afford a precarious support, a proper winter food,



*MACHINE FOR WEIGHING LIVE STOCK.*









well suited for their use and adapted to such situations, would be of the greatest value and utility.

The produce or profit of keeping sheep must obviously differ very considerably according to the circumstances under which they are conducted, the nature of the breed that is employed, and the goodness of the management pursued in keeping them. There are so many causes that affect the profits in this sort of husbandry, that it is probable no two sheep-farmers have exactly the same returns.—In the *Annals of Agriculture*, several detailed statements of the advantage of sheep-husbandry, when conducted on an extensive scale, are given with much clearness and accuracy. In Suffolk, according to Mr. Macro's account (which was not made directly with the view of shewing the profit that may be derived from sheep, but the disadvantage of a stout flock), the profit on 494 ewes is £16, or 8d. per head. But in Sussex, in Mr. Ellman's statement, on 560 ewes it stands at £147, or 5s. 3d. per head. And in the Duke of Grafton's estimate on 40 score it is £134, or 3s. 4d. per head.\* From the late improvements in sheep-husbandry, it is probable that the present estimates stand much higher.

Where the system of folding is practised, the sheep most adapted to the business are those of the more light and active short-woolled breeds, as the Norfolk, Wiltshire, South-Down, and some other kinds. This management has been hitherto considered as almost absolutely indispensable in many situations to the success of the farmer. It is, however, stated by Mr. Young, in his *Calendar*, that “a very great change has taken place on inclosed farms in the practice of the best farmers, especially in Norfolk. They are now fully convinced that it is an unprofitable practice, except where the openness of downs and common fields renders it necessary for the purpose of confinement. The number of sheep that may be kept on a farm without folding is much greater than can be supported with it. This is a very essential point. There is a deduction from the farmer's profit, in the injury done by folding to both ewe and lamb, which has been estimated by experienced judges at from 2s. 6d. to 4s. per ewe; so that a farmer should consider well, before he determines to follow a practice which, from a multitude of observations, is pronounced unprofitable. Mr. Bakewell used to call it robbing Peter to pay Paul. The arguments now used in its defence are not satisfactory; it is contended, that if sheep be not folded they will draw under hedges, &c. for shelter in bad weather; if so they ought to be allowed to do it, for more would be lost in such cases by forcing the sheep from shelter than the value of their fold. Where this practice takes place, good shepherds will, in case of rain, get up in the night and let their flocks out of fold, knowing the consequence of confinement on arable land in wet weather. The instinct of these animals will conduct them much better than our reason, not only where to fly for shelter, but also for choosing their own time to go to rest, and to feed in the morning. These they vary

\* See *Grazing*.



according to seasons and weather; but folding prevents it, and forces them to a regularity never called for by the weather."

It is remarked, that "when he began first to entertain doubts of the propriety of folding sheep on any farms in which they can be kept to certain fields in the night, without that practice, he desired earnestly to try some experiments that might throw more light on the question than it was possible for reason to do; but to effect this comparatively was very difficult, as the trial he wished for was such as should carry some positive conviction with it. He has not been able to effect it fully; but the trials he has made may not be found destitute of power to throw some light on this interesting question. He is perfectly persuaded, that it would have been impossible for him to have kept on the same land nearly such a stock in one parcel with folding. He does not conceive that the fields would have carried three-fourths so managed. Four drivings in a day make them trample much food, disquiet the sheep, and transfer the choice of their hours of feeding and rest from themselves to the shepherd and his boy. While lambs are young they are injured by this, and the ewes are liable to be hurried and heated: all which are objects that should weigh in the question. When sheep are kept in numerous parcels, it is only driving to and from the fold that affects them, but they are, in fact, driving about in a sort of march all day long, when the strongest have too great an advantage, and the flock divides into the head and the tail of it, by which means one part of them must trample the food to be eaten by another. All this points the very reverse of their remaining perfectly quiet in small parcels. But the question turns on the benefit to be reaped by the fold; for, if that be great enough to compensate for the loss by such circumstances, the practice may not be condemned."

Mr. Young suspects that "the reason why farmers are such warm advocates for folding, arises from the power it gives them of sacrificing the grass lands of a farm to the arable part of it. Their object is corn, by which they can carry off a farm whatever improvement they bring to it. Grass improved is profit to the landlord in future, and tenants are too apt to think that this is done at their expense.—They do not at all regard impoverishing a grass field in order to improve a ploughed one; and he need not observe, that every sort of sheep-walk is thus impoverished; so that antient walks, which have been sheep-pastured perhaps for five centuries, are no better at present than they ever were before; whereas most fields sheep fed, without folding from them, are in a constant state of amelioration; this leads him to remark the effect he observed on several of his own fields. He attended through the course of a summer many gentlemen over his fields, with a view to examine whether the sheep had seemed to have rested only on spots, to the too great manuring of such; or, on the contrary, to have distributed themselves more equally; and it was a pleasure to find, that they seemed generally to have spread in every part, if not quite equally, at least nearly so. The improved countenance of several old lays fed in the same manner, when examined in autumn, convinced him as well as his bailiff



that the ground had been unquestionably improved considerably. Those fields had carried a very bad appearance for some years; but they were, after sheep-feeding, of a rich verdure, and as full of worm-casts as if they had been dunged. He rolled them heavily in November, but they soon became rough again by worms, and demanded much rolling in spring. They had afterwards a greener and more fertile appearance by far than ever they wore before."

It is concluded "that the whole of this circumstance, the value of which he will be able to appreciate in the trials of future years, belongs to this method of dividing flocks, to the exclusion of folding. The fold is valuable, but so is the improvement of the grass land, and may, for what he knows, nearly equal it; when, in addition, we include the greater number of sheep that can be kept, and the favour done to them by letting them alone, there remains in his mind no further doubt of the fact. It is common to hear flock-farmers in open countries say, they have not the power to manage so. This may be very true, upon the major part of the farms; but such have often many inclosures, in which this management might be applied without difficulty. But if we suppose folding to be the system pursued, he may remark, that the farmers in those parts of the kingdom which understand it best, do not extend it so far as they might; they give over folding in November or December, whereas it may certainly be carried on through the whole winter with profit, even supposing that the practice is *necessary*: on those farms which have a perfectly dry gravelly pasture or two, it is advisable to fold all winter on such dry grass land. It must not be attempted on moist arable land, nor on moist grass land, but on dry pastures. The safety to the sheep is greater, and the benefit to the grass an object."

These are the arguments and experiments by which the utility of this long-established practice is assailed and rendered problematical, at least on farms in inclosed districts, where the sheep are capable of being confined in the pastures or other fields in separate lots, without this management. How far, in other cases, the injury sustained by the sheep in their thriving, and being more exposed to disease, with the trouble and inconvenience of the practice, weigh against the advantage of the system in providing manure as well as otherwise improving the tillage lands, and keeping them in a more restrained state by other means, remains to be shewn. The decision of the question involves various considerations of great moment to the stock as well as tillage farmer.

It has been suggested, that "there is another method of gaining all the benefit of folding quite through the winter, and on all soils; this is to confine them at night in a sheep-yard, well and regularly littered with straw, stubble, or fern; by which means you keep your flock warm and healthy in bad seasons, and at the same time raise a surprising quantity of dung; so great a quantity, if you have plenty of litter, that the profit will be better than folding on the land. A great improvement in this method would be giving the sheep all their food (except their pasture) in such yard, viz. hay and turnips, for which purpose they may be brought up not only at night, but also at noon, to be baited; but if their pasture be at a distance they should then, instead of baiting at noon, come to the



yard earlier in the evening and go out later in the morning. This is a practice which cannot be too much recommended: for so warm a lodging is a great matter to young lambs, and will tend much to forward their growth; the sheep will also be kept in good health; and what is a point of consequence to all farms, the quantity of dung raised will be very great. If this method is pursued through the months of December, January, February, March, and April, with plenty of litter, one hundred sheep will make a dunghill of at least sixty loads of excellent stuff, which will amply manure two acres of land, whereas one hundred sheep folded (supposing the grass dry enough) will not in that time equally manure one acre."

This business may be still further promoted by means of proper yards suited to the extent of sheep that are folded, with sheds on the sides for them to feed under; as in this way, by having the bottoms and under the sheds well covered with turf, bog-earth, marl, or the scrapings of roads, in the autumn and winter season, the sheep being kept on them in the day-time in bad stormy weather, and always during the night, with plentiful supplies of straw, stubble, fern, or any similar substances as litter, so as that they may be preserved quite dry and free from moisture, a vast stock of good manure will be raised. Such yards or standing folds, on this account, as well as that of improving the wool and affording shelter to the animals, deserve to be much more general than they are at present. These yards, both with and without sheds, are in use in Sussex: with sheds they are probably better than when wholly covered, as in the Herefordshire method; for in this last mode it is probably the sheep may be kept too warm, an equality of temperature being found of the most benefit in the economy of these animals. More experiments than have yet been made are wanting to show the advantages that may be derived from different methods of housing sheep during the winter season. There seems little doubt but that the quality of the fleece may be improved by it, though in the French manner it is said to have done harm.

Wherever the system of folding is adopted as necessary, it should be pursued with as much steadiness as possible, and have the business done in a perfect manner, for which purpose it may be sufficient to allow two square yards, or, in many cases, a less space, to each sheep, leaving them to remain two nights or more on the same spot; though the usual practice is to let them have more room, and remain a less time on the land. On tillage lands the surface should be very thickly covered over; but when in the state of sward a slighter coat may be sufficient. The lands under fallow for turnips or cabbages are in general best to begin upon, as the crops will be ready to be put in almost immediately afterwards. From these the farmer may proceed to the grounds in preparation for other crops, as the wheat fallows, being constantly attentive to put his sheep upon such lands first as are to be first sown, whether with grain or grass seeds. When on the approach of the winter season the weather becomes too wet for pursuing this system on the arable lands, it should be transferred to the pastures or other grass-lands; as on dry lands of this kind this management may be continued without much harm to the sheep, and much improvement in the land be effected. Where



there is much moss on the lands, this practice has much effect in removing it.\*

The time of clipping or shearing the sheep should be regulated by the state of the weather, and the climate in the particular district, as the summer season commences much sooner in the southern parts of the island than those of the north. In this way the danger of injury by cold, from depriving the sheep of their coats too soon, and from heat, by permitting them to continue on them too long, may be equally avoided. There is also another circumstance that should be attended to in this business, which is, that of the wool being at the state of maturity; for if the clipping precede that period it is weak, and can scarcely be spun, and if protracted later, it is yellow, felted, and imperfect. For the more warm sheltered situations in the southern parts of the kingdom, the beginning or middle of June, when the weather is fine, may be in general the most proper; but in the more exposed districts in the northern parts of the island, the middle or latter end of the same month may be more suitable, provided the season be favourable. But with the fattening sheep in the inclosures it will mostly be necessary to perform the work at an earlier period in every situation, as the great increase of heat from the setting in of the summer weather, added to the warmth of the fleece, becomes very oppressive and injurious to them in their feeding.

As the fleeces of sheep at this season become much loaded, and filled with dust and dirt of various kinds, before the business of shearing is begun, it is necessary to have the operation of washing performed. In the old method of executing this work, by the washers standing up to the breast in the water, there is not only much inconvenience and danger, in the men requiring a large supply of spirituous liquors, being attacked with colds, rheumatisms, and other diseases, but, from the uncomfortableness of their situation, often dispatching the business with too much expedition, so as to leave the wool insufficiently cleaned. It has been proposed, in the way of remedying these inconveniencies, that a stream or pond by a little contrivance will afford the means not only of doing the work well, but with comfort to the men. The method is to "rail off a portion of the water for the sheep to walk into by a sloop mouth at one end, and to walk out by another at the other end, with a depth sufficient at one part for them to swim; and to pave the whole: the breadth need not be more than six or seven feet: at one spot let in, on each side of this passage, where the depth is just sufficient for the water to flow over the sheep's back, a cask, either fixed or leaded, for a man to stand in dry; the sheep being in the water between them, they wash in perfection, and pushing them on, they swim through the deep part, and walk out at the other mouth, where there is a clean pen, or a very clean dry pasture to receive them. Of course there is a bridge rail-way to the tubs; and a pen at the first mouth of the water, whence the sheep are turned into it, where they may be soaking a few minutes before being driven to the washers."

\* See Folding, in section on the Cultivation of Arable Land.



Before this work commences, the lambs should be separated from the ewes and other sheep, and each placed in separate pens. When the former are washed it is seldom necessary to do much more than allow them to be just swilled through the water.

After this operation has been accomplished, the sheep should be provided with a dry clean pasture for a few days until they become perfectly dry, and are in a proper state to be shorn or clipped.

In the former method of performing this sort of operation, it was the custom of the shearers to perform the work lengthwise of the sheep; and in many cases it was very indifferently executed, so much so, that it has been supposed that one or two ounces of wool were left, upon the average, upon each sheep, and by that mean much injury done to the following growth, as it is conceived that wool in this particular has much resemblance to grass, and “will not thrive well if it be not cut close.” This imperfection in the clipping of sheep is believed to arise in a great measure from the longitudinal method of performing the operation. The improved practice is therefore to clip circularly round the body of the sheep, by which mean the work is believed to be more evenly as well as more closely executed. It is suggested, as probable, that the first inducement to this method of executing the business was that of improving the beauty of the animals. It is not unlikely but that convenience might also have some share in the introduction of this improvement, as it is extremely awkward and unpleasant for the operator to clip large sheep in the longitudinal method. The origin of this mode of shearing sheep is given by Mr. Young to Lincolnshire, whence it is supposed to have passed into Leicestershire. And it has since that period been introduced among the Sussex sheep-farmers with much attention by the Earl of Egremont: while the late Duke of Bedford and Mr. Coke have not been less assiduous in making it known in Bedfordshire and Norfolk. It is therefore probable that it will not long be neglected by the sheep-farmers in those districts where it may be yet unknown.

In managing this sort of business, besides the clippers, who are mostly persons that undertake the work, it is necessary to have a man to every three or four clippers, to draw and turn up the sheep ready for the operation. The business is mostly performed in a barn or other shady situation. Expert clippers seldom or ever cut or in any way hurt the sheep; but where they are not well accustomed to the work this may easily be the case, and much injury be done: it is of course necessary to be cautious in engaging persons for this sort of work. The number of sheep that can be clipped in the course of the day by an expert operator must vary according to circumstances, but in general it is supposed to be about forty.

With the grazier, where this sort of work is on a very extensive scale, it is mostly the custom to have the work performed by the number. The usual price is from 2s. 6d. to 3s. the score, the clippers drawing their sheep. But with less extensive sheep-farmers the work is often performed by the day, in which case 2s. 6d. with meat, strong beer, liquors, &c. is the common price for each per-



son. Mr. Young states the price in common clipping at “from 2s. 6d. to 3s. per score, for washing, clipping, and winding, labour being at 1s. 6d. a day.” At present we believe the expenses run higher than these statements.

It is necessary to have a proper person to wind the wool after the shearers, who should perfectly understand the business, as much in the sale depends upon this being well done, and that no improper substances be enclosed in the fleeces, as, where it happens, the farmer may find difficulty in disposing of his wool in future.

Mr. Ellman, an extensive South-Down sheep-farmer, clips off the coarsest of the wool on the thighs, and docks a month before the time of washing and shearing, which he sells, as locks, at 3½d. per lb.; the quantity being about four ounces per sheep. He finds this method to answer very well, keeping the sheep clean and cool in hot seasons. It is a practice in many other districts with other breeds of sheep, and is found to have many advantages, not only keeping the animals clean, but in ewes preventing their becoming sore in the udder.

The lambs are usually clipped or shorn a month or six weeks after the operation has been performed on the old or store-sheep. When this business has been done, both the old sheep and lambs should be marked with ochre or some other substance; and with some it is a practice to mark them in the ear or other part. It has been objected that, by marking with tar, injury is done to the wool; but Mr. Macro has shown, in the *Annals of Agriculture*, that the quantity employed does not amount to an ounce per sheep, so that no great inconvenience can be sustained by it.

It is a practice in some districts to dock the tails of sheep, which has probably originated in the idea of keeping the animals more clean, and free from the attacks of the fly. Some, however, conceive it improper, as preventing the sheep from being able to beat off the flies in hot seasons.

The *castrating* or *gelding* of the male lambs is performed at different ages in different districts: but it seems the most proper to be done in the first fortnight in the stronger sort of lambs; and in those of the weaker kind from a fortnight to three weeks, or a month old, according to circumstances. Some, however, advise its being done at a much later period. While done early, there is, however, the least danger of too much inflammation coming on if the lambs be in a healthy condition. When performed while very young on tender delicate lambs, mortification may, however, sometimes be apt to come on and destroy them.

The produce in wool differs greatly in different breeds of sheep; but in the pasture or long-woolled kinds the quantity is very considerable, though very inferior, in quality, to that of many of the short-woolled sorts. The finest wool is produced from the Shetland, the Herefordshire, and the South-Down, of any of the native sheep, and the greatest quantity from the Lincolnshire. The quality and quantity afforded by each sort of sheep has been already noticed in speaking of the particular breeds of sheep.

It is observed by Mr. Donaldson, that “the wethers have con-



siderably more wool than the ewes. In the fleeces of either there are several qualities ; some reckon eight or nine different sorts." These are all separated from each other in England by a set of men called woolstaplers, who are appointed for the purpose, and who are sworn to do justice between the grower and the merchant or manufacturer.

The business of the shepherd is considered by the same writer as "very important ; as on his due care and unwearied attention depend, in a very great degree, the welfare and value of the stock, and consequently the profit of the owner. The business of the shepherd is to superintend the flock at all times, and more particularly at the lambing season ; to take care that no improper tup intrude at the season of copulating ; to determine the proper time for shearing or clipping the fleece ; to draw out such sheep as are in condition for the grazier or the butcher ; and such also as from age or deformity are improper to be kept longer in the flock. He ought also to have a competent knowledge of the diseases of sheep ; of the proper remedies to be applied, and for the modes of application. In short, he ought to be diligent and attentive ; a competent judge of the good properties which the particular breed of sheep of which he is to have charge ought to be possessed ; and he should also, especially where the breeder is the grazier, be able to determine with precision what part of the flock is, and what is not, in condition for the butcher."

The usual method of ascertaining the age of sheep is, as in cattle, by their teeth ; they are also denominated one shear, two shear, &c. according to the number of fleeces that have been shorn from them. A sheep of one shear, or of one year old, has two broad teeth before ; a two-shear sheep has four ; a three-shear, six ; and a four-shear, eight, when it is said to be full-mouthed. After four, the teeth begin to break, shorten, and fall out. Sheep of different kinds and ages are also known by many other names in different districts.

Sheep are liable to a great variety of diseases, both external and internal, but the subject is much too extensive to be fully considered in this work.

The *Fly* is a disease to which sheep are constantly exposed in hot seasons, especially in inclosed woody districts. Various remedies are in use for the prevention of the effects of this dangerous insect. On the principle of its avoiding certain substances various applications have been made ; but that which is found the most effectual, with the least injury to the wool, is the flowers of sulphur in combination with some sort of greasy substance, such as lard, or butter, which can be drawn thinly over the wool by the hand. Where maggots are found it has been advised, instead of cutting the wool off the part affected, and scraping them off with the points of the shears, that the wool should be parted, and "the maggots picked out with a knife, or otherwise dislodged, without breaking the coat : and a quantity of white lead scraped from a lump among the wool ; which, being agitated, the powder is carried evenly down to the wound. Too much discolours the wool ; a little prevents any further harm from the maggots that may be left among the wool, driving



them away from the wound; and, at the same time, is found to promote its healing. In well-shepherded flocks, which are seen regularly twice a day, there is no such thing as a broken coat."

The *Foot-rot* is another disease that frequently attacks sheep, and which shows itself by their lameness, and the oozing of moisture between the claws, with a highly disagreeable smell: as the disease advances it gets under the hoof, throwing out proud flesh. It is supposed infectious from its spreading rapidly when not immediately eradicated. The part should be pared and cleaned without touching the quick, and the gravel dislodged, if there should be any, as soon as the disorder is discovered; the sheep being removed from the rest of the flock. A solution of the following ingredients should then be dropped on the part, and the foot be kept dry and free from dirt: two ounces of blue vitriol, the same quantity of roch-alum, one ounce of verdigris, and a quarter of an ounce of muriated quicksilver, dissolved in a quart of good distilled vinegar. The butter of antimony is likewise a good remedy.

The *Scab* is a cutaneous disease, something like the itch. When mild, and, the cure attempted in time, washing with tobacco-water will often remove it without risk; and sulphur ointment still more effectually.

But when the disease is more virulent, the cure is often attempted by the application of the common blue ointment of the shops, composed of quicksilver and hogs' lard, in the proportion of two ounces of quicksilver to sixteen ounces of lard; a pound of the ointment being sufficient for four sheep. The greatest caution should however be used in applying this ointment, especially with ewes that have lambs, as the latter are liable to be destroyed by being salivated. It should be laid on very sparingly in sheds at four or five inches apart.

The *Rubbers* are a sort of itch, in which the animal rubs itself to death, being gradually exhausted in consequence of not being able to feed. No effectual remedy has yet been discovered. The above may be tried.

Sheep are very liable to be affected with *blindness* from cold, and of course exposed to much danger from ponds, precipices, &c. The cure is sometimes attempted "by opening the vein below the canthus or inner angle of the eye, called the angular vein, then, by holding the creature's head in an inverted position, to make some drops of the blood fall into the eye, which operate two ways in effecting a cure of the *ophthalmia*; first by moderating the increased action of the vessels of that part, which is the proximate cause of the inflammation; and, secondly, the blood being admitted into the eye of the animal, will act, by reason of its mildness and its warmth, as an emollient, which also contributes towards a cure. After this operation the white specks on the eye are removed, and the sight completely restored. For this purpose some pound a little glass, that is blown into the eye with a quill open at both ends, which by its friction wears off these specks or scales."

A weak solution of verdigris in distilled vinegar has also been found useful occasionally applied by a soft feather. And it is



probable that white vitriol might be used in the same way with advantage.

The *Rot* is a disease with which sheep are frequently affected on moist wet lands. It is an affection of the liver and lungs, attended with a dropsy, and hitherto incurable. The chief thing to be depended upon in these cases is that of changing the sheep to a dry situation, or keeping them warm and sheltered, and giving them dry food in the yard. On this subject a curious fact or two are stated in the Survey of Lincolnshire. It is observed that in rotting years "the sheep that feed on the salt marshes, over which the spring tides come, sell very high in confidence that they are safe." And it is added, "that a shepherd, who, when young, was a shepherd's boy to an old man who lived at Netlam, near Lincoln, a place famous for the rot, told Mr. Neve, that he was persuaded sheep took the rot only of a morning before the dew was well off; at that time they folded, being open field. His master's shepherd kept his flock in fold always till the dew was gone; and with no other attention his sheep were kept sound, when all the neighbours lost their flocks\*."

The *Turn or Giddy* is a disorder with which these animals are often seized. This is probably a species of hydrocephalus, or an encysted collection of water in the head betwixt the dura and pia mater, which in these creatures is always accompanied with a *vertigo*, or continual turning about. In Lincolnshire, where it is termed "*sturdy* or *bladder* on the brain, there is an old fellow, near North Somercots, who trepan for it, and saves as many as he loses. He raises the skin with a sharp strong hooked knife over the spot affected, about the size of a crown piece; he then raises nearly the same size of the skull-bone, letting the piece hang as by a hinge on one side; then with a quill cut slanting to a point, like a spear, and barbed on each side, he fishes in for the bladder, and brings it out whole, putting down the bone again, and covering with a plaster. Sheep in this situation among the South-Down sheep-farmers are said to be *paterish*.

The *Resp* or *Red-water* is another disorder to which sheep are exposed. It is supposed to be induced by too much watery or succulent food, as turnips, rape, clover, eddish, and such like rich vegetable produce. It is not peculiar to sheep feeding on turnips or rape, as has been supposed. The use of common salt, and frequent driving about, has been supposed beneficial; and it is said that the disorder may be prevented by having recourse to dry food in the night, when the sheep are feeding on these succulent plants.

The *Braxy*, as it is termed in Scotland, and which seems to be of the nature of the *gastritis*, is probably the same disease as the above: it is said to be not only the most fatal of all the diseases of sheep, but to have hitherto baffled all the skill and art of man. Some farms are more liable to this disease than others, and it was altogether unknown in the Highlands until they began to introduce a new breed,

\* Much light has been lately thrown on the nature of this disease by Dr. Harrison in his "*Inquiry into the Rot in Sheep and other Animals*."



and to leave their sheep at all seasons in the fields. A change of grass, especially to clean grass or clover forage, in the latter end of autumn, has often been tried successfully. The only remedy, indeed, seems to be to try to prevent a disease which, after infection, “has in all instances been found hitherto incurable.” It is found most fatal within the region of the hoar frost, as it makes less havoc, and is scarcely felt in situations which are more elevated and more remote from the tracts of rivers, marshes, or large bodies of fresh water.

“As an antidote against this distemper the sheep are sometimes chased with dogs, and not allowed to remain long at once without being disturbed at the season in which danger is apprehended; for whenever a sheep stops after having been annoyed, he passes water: and as the bladder is generally burst of such sheep as die of the braxy, a part at least of the complaint may be a stoppage in the urinary passage.”

The *Black-water* is a disease to which the best lambs are often subject in the autumn. They mostly die very suddenly. The best preventative in this case is supposed to be that of keeping them in dry stubbles, or where the grass is very dry.

The *Skil* in lambs, both white and green, are probably best removed by the use of a decoction of chalk and hartshorn-shavings, with a small proportion of tincture of opium. Sheep are liable to various other complaints, but they have been described in so vague a manner, and the remedies proposed are of so doubtful a nature, that it could be of little utility to mention them.

It is probable that by the use of salt, especially in wet seasons, and on the wetter sorts of land, where sheep-husbandry is practised, much advantage might be gained, in the health of the sheep being better preserved, especially if some sort of dry food was had recourse to at the same time. It is a substance commonly employed in the sheep-management of most other countries, and of which the animals are particularly fond, though the quantity consumed is not great. The practice is to allow the sheep to lick it up from shallow troughs. The heaviness of the duty upon it is, however, a great bar to its being made use of in this way.

*Horses.*—These animals are indispensably necessary, whether they be considered in regard to the saddle, or performing the business of the road or the farm. The circumstances which denote a good horse, whatever the nature of the breed or variety may be, are that the head be suitably small in proportion to the animal, the nostrils expanded, the muzzle fine; the eyes bright and prominent, the ears close, small and erect; the neck proceeding with a gentle curve from between the shoulders, so as to join gracefully to the head, the shoulders well thrown back, imperceptibly sinking into the neck at the points, the arm or fore thigh muscular, tapering so as to meet a fine, sinewy, straight, boney leg, the hoof circular and wide at the heel; the chest deep and full at the girth, the loin or fillets broad and straight; the body round, the hips or hooks not wide, the quarters long, the tail set on so as to be nearly in the



same right lines as the back ; the thighs strong and muscular, the legs clean and fine-boned ; the leg-bones rather flat than round. For the uses of husbandry the chief properties to be considered are, however, those of strength, activity, hardiness, and true draught.

The breeds of horses have in general been considered as only two ; the blood or race-breed, and the black cart-breed. But whether this division be well founded or not, the varieties are distinguishable from each other with equal ease by the appearances which they present.

The true bred blood-horse is much too fine for the purposes of husbandry ; but when judiciously crossed with the strong sort of cart-horses, improved horses for this use, as well as that of the saddle and light carriages, may be produced. By such means the action, spirit, and pleasantness of horses may be greatly improved.

The *Cleveland-bays* are a breed or variety of horses that have derived much advantage in this way. They are principally distinguished by the colour, which is mostly bay, their form good, their size large, and their activity, strength, and hardiness superior to most other sorts. With full-blood stallions this variety is said to afford excellent hunters and saddle-horses ; and with half-bred stallions, excellent carriage-horses and for the plough. They move quick, and are capable of great exertion. This valuable sort of horses is produced in different parts of Yorkshire, Durham, and Northumberland.

The *Suffolk-punches* are another useful sort of horses for the purpose of the farmer. They are distinguished by the colour, which is mostly yellowish or sorrel ; by having a white ratch or blaze in the face ; by the head being large ; ears wide ; muzzle coarse ; fore end low ; back long, but straight ; sides flat ; shoulders too far forward ; hind quarters middling, but rather high about the hips ; legs round, and short in the pasterns ; deep bellied ; full in the flank ; not large in size.

This on the whole, though but an ordinary sort of horse in regard to form, is found highly useful in draught, especially for the plough and cart. These horses are very hardy, and capable of performing more labour than most other sorts. They are most prevalent in the district of High Suffolk.

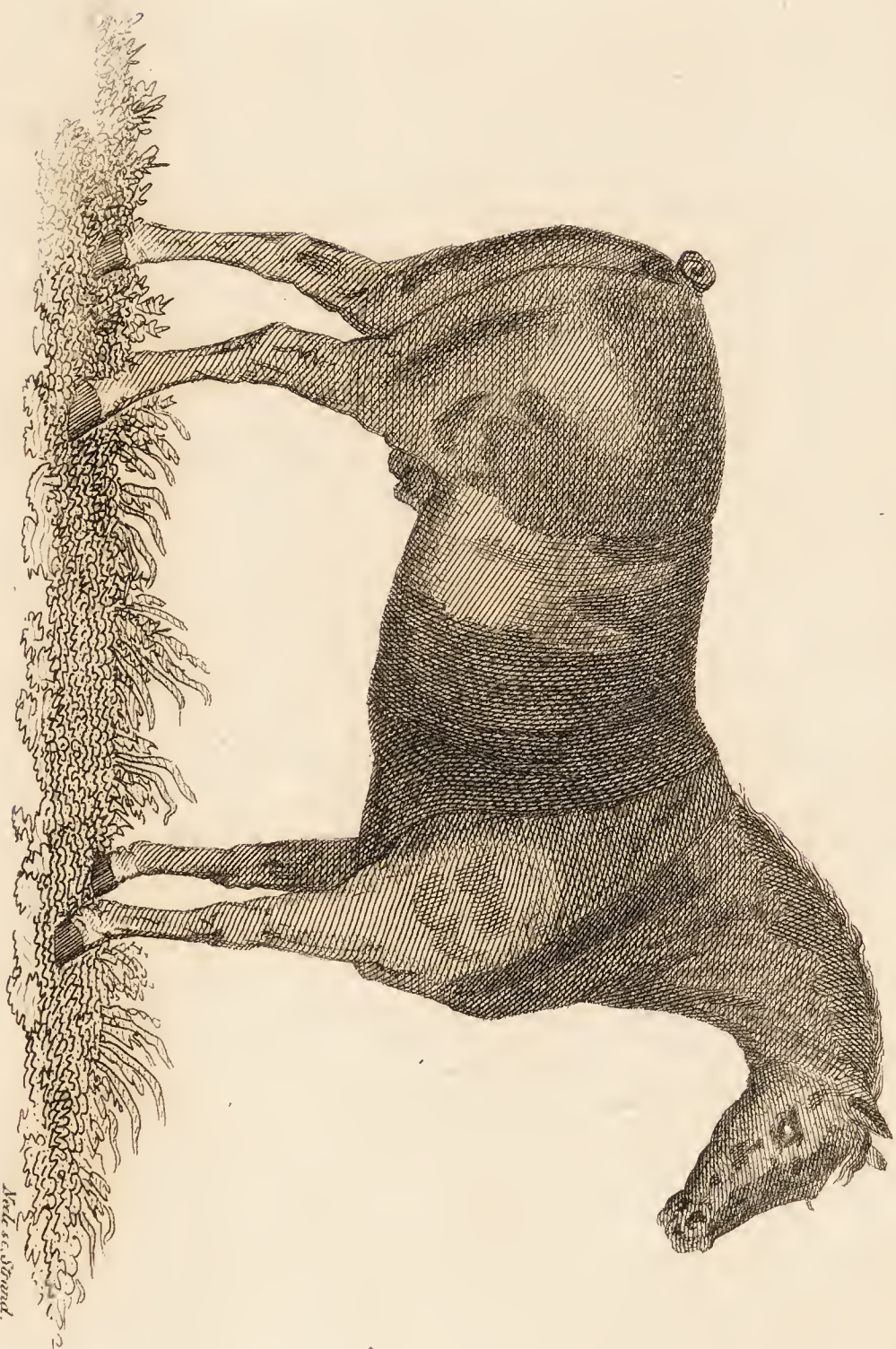
The *Clydesdale horses* are likewise a kind of horses that answer well for the business of agriculture, especially in hilly districts. They are distinguished by the colour, which is mostly grey or brown, neck longer than in the Suffolk kind, head better formed, eyes more sprightly and animated, body lighter and better formed, legs clean and sinewy, step firm but nimble ; size larger, from fifteen to sixteen and a half hands.

This is a strong, hardy, and active sort of horse, which is said to have been produced by crossing Scotch mares with Flanders stallions. They are remarkably true in the draught. This sort of horses is predominant in the district which bears their name in Scotland.

The *Heavy Black horses* are a sort that may be employed with advantage for some purposes of draught, but are not in general well



A STEEPLER PUNCH HORSE.



W. L. G. Ward.







adapted to the uses of the farmer. This kind is distinguished by the colour being constantly dark black; by being clumsy in their form, and seldom well proportioned: slow in their motion: with rough fleshy legs; the size large.

This breed of horses is found to prevail in the Midland districts, as in Leicestershire, Derbyshire, Lincolnshire, &c. where the mares are chiefly employed in farm-labour, the horses being disposed of according to their sizes, the largest for dray-horses, the next for draught in waggons or other teams, and the smallest for the purposes of war.

The *Welsh* and *Scotch* horses are in general too small for the purposes of agriculture.

It is evident from the nature of these different sorts, that for the purposes of farm-labour, horses must be chiefly selected from the Clevelands, the Suffolks, and the Clydesdale kinds, the first affording such as are adapted to great exertion and dispatch, the improved sort of the Suffolk kind being well suited to field-work, where much perseverance is required, as they can be constantly employed in this sort of labour without inconvenience. And the last sort, from the great muscular exertion that can be occasionally employed, as well as from their being true in the draught, are particularly suited to hilly situations. In respect to economy in keep, and the expense in procuring, the two last sorts are probably to be preferred, as they are both very hardy in their dispositions, and can in general be obtained at easy prices. From the great advantage that has lately been found by employing, even for the purpose of draught, in the more heavy sorts of carriages, such horses as have a little of the race or blood kind in them, the use of the heavy breeds is becoming daily less frequent and necessary.

The practice of breeding horses, as it requires a great extent of pasture-ground and capital, from the great number of mares that must be constantly kept, and a deal of nice and attentive management in the servants that are employed, it is only in particular situations and circumstances that it can be attempted with success, as where the proportion of coarse pasture-land, that cannot be converted to the purpose of grazing or fattening animals on the farm is considerable. This is the case in the fens and marshes of Lincolnshire, and some parts of the North Riding of Yorkshire, as well as other districts: In such situations, however, with proper knowledge, and due care in the management, great advantage may often be derived. Wherever this system is undertaken, the same care and judgment must be exercised in selecting such mares and stallions as are the most suitable for the particular purpose which the farmer has in view in breeding them, as have been recommended in the propagation of other sorts of live stock, as without this sort of attention it is impossible that the greatest benefit can be obtained. The too common custom of breeding from any mare that may chance to be in the possession of the farmer should never be adopted. It is only by covering well-made and tried mares by stallions that are equally well-formed and known for their good qualities, whatever the breed may be, that valuable horses can be produced.



The season of putting the mare to the horse is the spring, as April or May, as in breeding colts it is of material consequence to have the foals dropped early, often so soon as in February or the preceding month. In Yorkshire, the most usual period of foaling is about May-day, and that of weaning towards the latter end of September. In the length of time that a mare goes with foal there is frequently considerable variation, but it is mostly about eleven months. This is a circumstance that should be kept in mind by the breeder.

While with foal, it is of importance that the mare be kept pretty well, as in the contrary case the foal is seldom so fine or healthy. It is a practice with some farmers to perform the work of their farms with breeding mares; but this method requires much caution, and is always attended with a degree of danger. Besides it can scarcely ever be worth the farmer's while to breed where the foals will not defray the expense of keeping the mares without their performing much work, either before or after they have foaled. In some cases, especially with farm-mares, it may, however, be beneficial to work them a little carefully, by way of exercising them, but they should not on any account be hard wrought when with foal or while suckling.

The foals should continue to suck till towards the beginning of October or November, the mares being kept as well as possible, in order that their growth may not be checked from the want of milk while young. When taken from the mares at first, it is a very good method to let them have an open roomy house with a rack and box for their food; and if it communicate with a small field or paddock, into which they can run, it is of great advantage in the rearing of the foals, both in the way of food and exercise, as they should never be too much confined. By being more at liberty they become not only more strong and healthy, but acquire more and a better action, which is essential in the horse.

The dry food should at first consist of the nicest and most sweet hay of whatever sort it may be. Sweet green *rouen*, where it can be provided, might be very useful in this intention. Carrots are likewise found an extremely beneficial sort of food in the rearing of foals. It has indeed been thought scarcely possible to breed horses to any profit without a considerable dependence upon them. Their laxative property is also supposed by some highly beneficial in the raising of foals. With these sorts of food it is necessary always to make use of oats and bran, or pollard, in suitable proportions, as it is only by these means that these young animals can be brought forward in the best manner. When there is sufficient grass in the spring, it is a proper practice to turn the foals out into a convenient dry pasture, where there is rather a short sweet bite, and a good supply of pure water for them to drink at as often as they like. In the second winter less care will be required than in the first; but the same indulgence, in respect to the liberty of their going in and out of the shed at pleasure from the field, should be allowed. In this mode of rearing foals they will become useful at two years old, when intended for the work of the farm; and if for sale, be in a condition to fetch a good price: which would not be the case if they



were kept in an inferior way. But there is another circumstance to be taken into the account, which is, that it is this variation in the keep that constitutes the difference between a good and bad horse; which, as it chiefly consists in the addition of the oats, is no very great affair, at least upon good horses, whether for saddle or work. Upon horses of low value it will not probably repay the breeder to bestow this sort of keep upon them. It can seldom be advisable for farmers to pursue it in horses that are worth less than from twenty-five to thirty pounds at four years old; where oats are made use of as a part of the food of young horses, care should be taken that they are *really* given to them.

In some parts of Yorkshire, the farmers, instead of breeding foals, pursue the system of buying colts in yearly, when two or three years old, which they keep till four or five, using them for the purposes of the farm: they are then sold to the London or other dealers. But this management their stock is kept up, and they make a considerable annual profit, besides having the internal work of the farm performed. They are principally employed in the plough, and in many cases not shod till the period of being sold. When intended for the carriage, this easy sort of work is found of advantage in rendering them more quiet and tractable. In other districts it is the practice to buy in at three years old, in the autumn, keep them during the winter on straw, work them a little in the spring, and sell them in the latter end of summer at the fairs in the vicinity, by which method good judges make money.

The Yorkshire farmers, who mostly raise their foals from their working mares, are often careful not to allow the foals to suck till the udders of the mares coming from work have been well bathed with cold water, and a great part of the milk drawn away.

The propriety of castrating horses has been disputed by some, as being disadvantageous in the loss of vigour that it causes. The practice certainly proceeds on the principle of sacrificing a portion of the strength of the animals to the convenience of managing them. This, in many instances, is without doubt necessary as well as convenient; but there can be no difficulty, by proper management, in making stallions perform the business of a farm, which, from their superior strength, is supposed by some, on experience, to be executed with great advantage over that of using geldings.

Where the operation of gelding is to be performed, the best time is probably when the foal is about three months old, though some prefer a much more advanced age, as six or twelve months, and even more in some cases. In all animals there is, however, the least danger of inflammation while they are young in performing such operations. Besides, it is better to cut colts before they have any propensity to hanker after the mares and get bad habits. When the foals are early, and the weather is not too hot, the latter end of May or beginning of June may be a good and proper season.

Some of the Yorkshire breeders, however, think that they find advantage in deferring the operation till the horses are two years old, as they suppose "they become stronger and handsomer for it." And where the operation is done at one year old, they find that the



foals have not recovered the check they sustained by weaning, before they experience another in this operation. They experience no more difference in their recovery at two years old than one. The foals should be kept up some time before the gelding is to be performed.

In performing the operation, the best method is that of cutting open the *scrotum*, or cod, with a sharp knife for the purpose, dividing the spermatic cords and vessels, taking out the testicles, and then securing them by means of ligatures, closing the wound immediately, the ends of the ligatures being left out at some part, so that they may be drawn away as suppuration advances. This is much better than the old practice of searing with a hot iron, or the more recent one of causing the separation of the scrotum and testicles by *twitching* or tying them tight with a small string.

In the breaking of horses there is seldom much trouble if the business be well managed, and undertaken sufficiently early. In farm-horses the best method is probably that of haltering the foal as soon as it is taken from the mare, leading it from place to place till it becomes perfectly quiet and manageable; then to have it tied in the stall, and cleaned in the manner of the other horses, accustoming it to have its feet taken up and cleaned when necessary. These methods should be continued till it becomes perfectly tractable; it may then be put into the middle of the team in proper harness, so as that it may be forced about by the other horses, without having any thing to draw. When it is quite gentle in this situation it may be backed, if that has not been done before. In order to give it a mouth, a small bit should be let to hang loose in its mouth till it becomes accustomed to it, and then it may be managed in any way at pleasure, being taught not only to walk, but trot, and even gallop well. In this treatment it soon becomes perfectly tractable and fit for any use on the farm.

In making up young horses, as two-year old colts, for sale in the autumn, the Yorkshire breeders turn them into good grass, taking them up about a week before the period of selling to reduce the carcase, improve the coat, and teach them to lead. They are mostly disposed of with their full tails. Mashies of bran, ground oats, and boiled corn, are then given them by these persons for two or three months, and various other operations practised upon them in order to render them more saleable.

It is a question that has been much agitated, whether horses or oxen are the most economical and advantageous for the purposes of the farmer in performing his work, and which is not yet fully decided. The circumstances in which the latter have been chiefly supposed to be more advantageous than the former, are in their being kept at less expense, and their not declining in value. But these, when examined, are probably not so decisive of their superiority as they may at first sight appear; for where the work of the farm is done by the younger sort of horses, which is perhaps the best method, the decline in value cannot be of any material consequence, while the superiority in point of the dispatch of work is very great. And in regard to the keep, as oxen cannot perform their labour well in continuance without oats or some other sustenance of a similar



kind, it would seem not improbable but that young horses may pay nearly as well as oxen, and be kept with little difference in the expense. The principal difference appears to be in the oxen being supported at less expense when not employed. But horse-teams under proper management should never be unemployed.

The common opinion, that oxen are superior to horses in the tillage of heavy lands, does not appear to be well founded, especially where drawn in yokes, as the poaching must be greater than by horses working at length. But when in harness they may, from their greater steadiness, be preferable. Under different management they are consequently capable of being employed in both ways.

Horses are, however, greatly superior to oxen, where quick motion is of more importance than the steady drawing of heavy weights; and also in carting, where great speed is required in the unloaded state; and wherever the roads or lands are rough, sharp and stoney, as they cannot be shod so well as horses to stand such roads. In harrowing with light harrows, where a jumping irregular motion is necessary, horses are likewise said to be the most proper.

Mr. Young, in his valuable *Calendar of Husbandry*, has however well remarked, that “there are two cases in which oxen are certainly more beneficial than horses: First, when a farmer lives in a district where there is a breed of cattle well adapted to work; and, secondly, when his farm is so large that he can buy in a considerable lot of cattle annually, at a small expense per head, and feel no inconvenience in turning out such beasts from the teams to fattening as do not work well. In both these cases he has little doubt of the superiority of oxen to horses. But in countries that do not possess a breed of cattle well adapted for work in the state of oxen, and on small farms, whence fairs must be attended at the distance of a hundred miles to purchase a few, and consequently at a great expense per head, and possibly without land for fattening any, the benefit will be very questionable. In such a case he should prefer the bulls of the country, which are every where to be procured, probably, much cheaper than oxen; are broken in with but little difficulty; which work well, and which will recover from fatigue sooner than any ox. This he believes from what he has experienced, and from all the information he has procured, is stating the question of the comparison of horses and oxen as nearly to the truth as it can be done in few words. There are, however, some works in the business of a farm in which horses are better than either oxen or bulls, and therefore it may be advantageous to keep a few horses.”

The feeding of teams, whether of horses or oxen, is a point that demands much care and attention, as a want of economy in this respect may lessen the profits of the farmer in a very material degree, as is evident from the greatness of the consumption of expensive food. It has been found, that working-horses, without being fed too highly, or so as to improve in flesh, have consumed in the proportion of twenty pounds of good hay each in the course of the day, with a weekly allowance of two bushels of oats each and chaff. With a smaller allowance, which is often made by farmers, they cannot be constantly kept at work without falling off in condition,



by which there must ultimately be a loss to the farmer. The above allowance is necessary for about twenty weeks during the winter.

To lessen the heavy expense of keeping farm-horses, it has been suggested that there are only two methods, one of which is not to turn them out in the summer, but to have them soiled constantly in the stables or yards with lucern, tares, and clover, as in this way, where littering is properly attended to, the manure that is produced will nearly balance the expense of the keep, besides avoiding various inconveniencies attending the pasturing of horses in the fields. The other mode is that of substituting carrots in the place of oats as a winter food, a practice common in the county of Suffolk, and attended with much success. Estimating the prime cost of carrots to the farmer at three pence the bushel, and that of the oats at ten shillings the quarter, and allowing the customary quantity of one bushel of carrots a day against the two bushels of oats in the week, the horse at carrots consumes in the proportion of 1s. 9d. a week; while that at oats is 2s. 6d. Besides, the superiority of this proportion of carrots to that of the oats, in the support of the horse, is very considerable; probably five bushels of carrots per week would be equal to it, as in this district they consider a bushel a day feeding highly. These prices are much too low for the present period, but they fully shew the difference in the expense.

But, besides this excellent root, there are others that may be made use of in feeding horses in order to save oats; boiled potatoes, with a little chaff, and a few carrots, have been attended with perfect success in the trials of Mr. Guthrie, in Scotland, keeping the horses in fine order without any oats. And in England they have been applied in the same way with similar success.

There is another point to be regarded in the feeding of horses, in order to its being done in the most economical manner, which is that of having as much of their dry fodder as possible, such as hay and straw of different kinds, cut into chaff, before it is given to them with their other food. And it is probable that by having the oats broken or bruised, not ground, as has been often recommended, some saving in that expensive article may be made, though it has been contended by some that horses do not thrive so well when the oats are prepared by grinding. It is probable that, when reduced into too fine a state, they may not be so well digested from their being swallowed more greedily, and without the *saliva* of the animal being so intimately blended and combined with the substance of them, as when left so as that some degree of chewing becomes necessary. But even when given in the whole state, some horses swallow much of them without due mastication, as is obvious from their being voided in a perfect state, and so little changed as to be capable of supporting poultry and other granivorous birds. Consequently something in this matter depends upon the habits of eating in the horses. By the use of barley instead of oats, perhaps some degree of saving might be made, as that sort of grain would go farther than oats in the same proportion. It has been objected to in this intention by some, from its supposed heating quality: but from its having a more laxative or opening property than oats, it would seem to have the contrary



effect; and as a proof of which it is found to be the ordinary food for horses in most hot countries. It may probably be more unfavourable from its aperient property in many cases, in the feeding of horses, than that of its supposed heating tendency. Experience has, however, shown that it is a hearty and nutritious food when applied in this way.

In situations where the *furze* or *whin* plant can be grown with facility, a degree of saving in the hay as well as corn may be effected by the use of it, cut green while young, and bruised in mills for the purpose. It has been found from some experiments that an acre will afford 15 tons of this sort of food, and by others as much as will feed six horses for six months.

In the feeding of ox-teams, equal care and attention is necessary to see that while they are perfectly well supported no waste of food is made, which is often the case with incautious feeders. When at hard work in the autumn and beginning of the spring seasons, they should have a good supply of hay, straw, and cut chaff, with a daily allowance of some sort of roots, such as turnips or carrots, or a sufficient proportion of cabbages, as from forty to fifty pounds weight where the oxen are large. But during the summer they may be soiled in the stalls or yards in the manner of horses, a full supply of litter being provided, and water for them to drink when wanted. When at plough in the beginning of the autumn, it will be necessary to give them oats and cut chaff in such proportions as may be requisite, as the grass at that period begins to be less nutritious.

In the working of teams, whether of the horse or ox kind, one circumstance is to be constantly kept in view, which is, that, as their keep is so very expensive, they be always employed; as it is obvious that if they stand idle half or a third of their time, the labour that is performed must cost the farmer double, or a third more than in cases where they are constantly at work, and of course much loss to be sustained. On arable farms this is particularly necessary to be attended to; and of course in the autumn and winter, when the business of the plough is at a stand, other sorts of team work, such as carting, in the former, on light dry soils, chalk, marle, and clay, and on the wetter grass lands, manure, in small carts, and in the latter, in frosts, manures of the compost or other kinds, removing various sorts of earthy materials from borders and other places, for mixing with or forming the bottoms of dungsteads; and when the weather is open, in taking the corn, and bringing manure, or any other business that is to be done; as it must always pay the farmer to have it accomplished in such circumstances as that the team must otherwise remain unemployed. The keeping of teams upon poor food, such as straw, during the winter, in order that they may not be in work, is always bad management, as their labour in the rest of the year must stand the farmer very high. In the seed time the farmer should be very careful that they perform a proper day's work. Mr. Young thinks that in this season the farmer "should not let them work less than nine or ten hours; but this he will not be able to effect if the ploughmen have to take care of their horses. It is the best to have horse-keepers, for the mere attendance of the teams,



so that the men who hold the ploughs may have nothing to do but the mere ploughing. Let the horse-keeper have the horses fed and harnessed ready for the ploughman, to be in the field by six o'clock. At eleven they should come for an hour and a half to dine and bait, during which time the horse-keeper is in attendance again. At half an hour after twelve, they should go out again, and work till half an hour after five, when the horse-keeper should again take the teams. By this method a pair of horses in a well-made plough will, without any driver, plough an acre and a quarter, or half, very easily; and no object is more important, than the plough's doing a good day's work in the spring of the year. The consequence, especially of making the most of dry weather in March, is extremely great. One acre ploughed and sowed then may be fairly worth two that are left till the beginning of May."

When the fields are at a distance, it may however be more advisable to have the teams baited in them than to come home for the purpose, especially in the autumn and winter seasons when the days are short.

Where the above management is adopted, a great deal more work will be done than when the *carter* or *head man* has the care of cleaning and managing the horses, as, in order to give himself more time, he takes every means of shortening the day's work. An odd man, who can be occasionally employed on other jobs, and fully depended upon, may be proper to be made use of as horse-keeper: the farmer being attentive to see that the horses be well cleaned in the more concealed as well as other parts.

Mr. Bannister remarks, that "the management of the plough-team varies essentially in different counties, and even in different parts of the same county, whether the labour to be performed as a day's work by the same number of cattle, the quality and quantity of their food, or the stated hours for baiting and attendance be considered. In the eastern part of the county of Kent, the waggoner or head ploughman pays an early regard to his horses, and baits them continually with chaff and corn from the time of his rising at four o'clock till six or seven, when the day's work commences; and in the afternoon, whilst the mate is baiting, the waggoner employs himself by cutting *caving* into chaff, or, where this is not in sufficient plenty, hay and straw mixed, and sometimes oats in the sheaf. At eight in the evening he goes to bed, and leaves the attendance on the team to his mate, who sits with them till ten, so that the horses are left but a few hours to themselves; and this diligent attendance is unavoidably necessary, since in this part of the county the horses are not permitted to have any rack-meat, but have generally a full allowance of corn; whereas, on the other side of the county, the stable door is rarely opened of a morning before five or six o'clock in the winter, and by nine in the evening the horses are racked up and left to their repose: and as by this method of giving the horses rack-meat the less chaff is required, so there is generally a sufficient quantity of this produced by the thrasher; if not, the labour of cutting does not often fall to the ploughman, but is paid for by the farmer to a person who is expert at this business."



By the former practice there is, it is observed, a reserve of a considerable quantity of fodder, which, when given to the horses without limitation, forms a large item in the rural account at the end of the year, especially when the situation is within a small distance of London, or any place of considerable note, where hay usually fetches a large price; to which may be added the advantage which the horses reap from the constant attendance that must necessarily be paid to them when baited in that manner: besides, the servants are kept continually in their work, and prevented from loitering away the afternoons at the ale-house, or the smith's shop, as is too frequently the case with those who have more leisure on their hands; a great expense is likewise saved, which must otherwise be paid, for cutting chaff. On the contrary, where the more general custom of allowing rack-meat to the horses is practised, the following advantages may be derived: the weekly allowance of corn may be more sparing, and the rack-meat need not be wholly confined to hay, but consist partly of pea or bean straw, at those times when the labour of the horses is light; and in seed-time, or whenever the team is tasked with heave work, though saintfoin, clover, &c. may be allowed them of a night, yet this need not be given in such large proportions, which would quickly consume a large quantity, but be trussed out in such proportion as may be thought expedient, obliging the servants to tend the horses with chaff in the afternoon. Under these restrictions, the consumption of fodder may, perhaps, not exceed in value the sheaf-corn allowed to the teams in the former management.

Another circumstance in favour of this practice is its leaving the ploughman at leisure in the afternoon to be employed about occasional jobs, while, in the contrary mode the servants have a just excuse for refusing to help in any other work than what appertains solely to the management of their horses.

There is also a third consideration, which may ultimately turn out of more consequence than either of the former, and that is the opportunity enjoyed by the farmer who gives his horses rack-meat, of seeing the stable-door locked up at night and opened again in the morning; which cannot be so conveniently done where the ploughman is to sit up late and to rise the next morning at three or four o'clock; and thus an object of the most serious import is left to the care of persons who are rarely deserving of any trust; namely, the danger from fire, as well as the great waste of candles.

Some advise the keeping of team-horses in stables, with short stalls for each horse, so that he may eat his feed separately, and be harnessed with more ease; the partitions not being carried to the ceiling, in order to admit of a more free circulation of air; while others contend for open sheds, with racks and mangers fixed below, having a pump and cistern, and a small yard for them to go in at pleasure, as in this method they are found to do better without dressing, than in stables with the ordinary management bestowed by farm-servants. In the practice of the Earl of Darlington it was found to answer well. In Suffolk it is likewise the practice with many to turn them into the farm-yard in the nights. The open shed



method with yards does well for feeding on hay and carrots in winter, and soiling on green food in the summer, but they should be constantly well littered down.

It is probable, however, as horses seldom do very well when much exposed to cold, that the stable system may have its advantages in the more northern districts; while the open shed mode may be preferable in the southern parts of the island, where the winter season is more mild and favourable.

Corn-chests and chaff-bins should likewise be provided, and it is of consequence to have them conveniently placed for the purpose of feeding the teams. The former should be of sufficient dimensions for containing the weekly allowance of corn for the team, and be placed on blocks of wood on the ground, being furnished with a proper measure and sieve to mix the feed in with the cut chaff. Each carter should have one, and be provided with a lock and key to it: the chaff-bin must be placed in the centre of the stable when small, and in large ones two may be necessary; they should be made from about five to seven feet square each.

The expenses attending teams are liable to vary much, according to the horses, the manner of feeding, and other circumstances, but the amount of oats for well-fed horses is mostly found to be about ten quarters, and that of hay a ton and three quarters. Shoeing about sixteen shillings. The rest of the items are liable to much variation.

Another point in respect to teams, which is of great importance to the farmer, is the proportion of horses or other animals that are requisite to the extent of land. It is plain that the nature and situation of the farm, and the method of husbandry that is practised, must have great influence in regulating the number of horses or oxen that will be necessary in its cultivation. It has been observed, that one team, on a gravelly, sandy, or other light description of soil, will be capable of performing more labour, or of cultivating a greater proportion of land in a given time, than two on soils of the clayey kind, where the various operations are greatly retarded by their stiffness and adhesion. And that where the situation of the farm is hilly and uneven, a greater strength and extent of team will be requisite than in the contrary circumstances, in order to answer the purposes of tillage. Where, from the nature or locality of the farm, much road-work is to be performed to a distance, a more powerful and fuller team will be wanted than in other cases. The proportion of the grass or feeding land to that of the tillage is likewise to be considered, in determining the number of labouring cattle for the farm, as, where the extent of the former is considerable, there will be less work to be performed, and of course one team may be sufficient where two would otherwise have been required.

On hay and dairy farms the teams are generally small, as they require little more than the conveying their different products to the markets, and the carting of manure, or such other materials as may be necessary in the management of the farms: but as the culture of different sorts of green crops is necessary to the perfect and most economical management of the latter, a somewhat larger team will,



in general, be required. In most cases, from three to four horses will be sufficient on such farms, for from one to two hundred acres, or even more.

But on perfectly arable farms, especially where the old fallow method of husbandry is practised on one-third or fourth part annually, or on such as are cultivated under the convertible system, a much greater extent of team will be required. In the latter case, however, and in the former also, where the improved method of substituting green crops for fallows is pursued, considerable reduction in the number of animals that constitute the teams may be made. In the eastern districts, it has been common to employ four horses on farms that contain only forty acres of tillage-land with a suitable proportion of grass. And with seventy or eighty acres under the plough, and thirty or more in the state of grass, six horses have often been employed. And in these cases seldom more than two horses made use of as a team. In districts where not less than three or four constitute a team, the proportion is still higher. But under good management, in the improved methods of cultivation, a much less extent of team may be sufficient. The business of forty acres in tillage, with thirty or more in sward, and a few in wood, has been accomplished without difficulty by a pair of good horses. And two oxen with one horse would in many cases be adequate to the same extent of land. With two horses and four oxen, the labour of an arable farm of from one to two hundred acres or more may be managed without inconvenience. Some advise the use of ass and mule teams in small concerns, as highly economical; the former being hardy and easily kept, and the latter capable of being worked to a great age. The small mules are the most hardy and useful.

The diseases of horses are so numerous that they cannot be fully considered in a work of this nature; but it may be useful to the farmer to know a few of the most appropriate remedies in those that are the most common and most frequently occurring in his teams. These are *wounds, bruises, sprains, warbles, colds, colics, staggers, strangles, jaundice, or yellows, worms, botts, glanders, farcy, grease, mange, &c.*

In common recent wounds the best method of treatment is to bring the sides of the divided parts immediately into contact, where it can be done, keeping them in that situation by slips of adhesive plaster, as by this means they may be the most expeditiously healed. Where there is much laceration of the parts, after such of them as can be brought into union have been washed and cleaned by a soft sponge, and placed in their proper situations, and confined in the manner just directed; if on the first removal of the dressings, which should not be for some days, any part remain unhealed, it should be dressed with lint moistened by the tincture of myrrh, adhesive plaster being laid over it. When in the process of healing the granulations of new flesh rise above the surface, they must be kept down by the use of blue vitriol, once or oftener in the day, and proper compresses, the other dressings being wholly discontinued.

If the destruction of parts be considerable, in order to promote suppuration, the application of warm saturnine fomentations or



poultices may be useful. And inflammation should be guarded against by bleeding, and the use of nitrous mashes, &c. Where circular bandages can be applied they will be found useful.

Wounds from punctures, as of nails, thorns, &c. may be dressed by lint dipped in the tincture of myrrh, and secured by adhesive plaster; the hair being first clipped away; and the surrounding parts should be well bathed with a camphorated embrocation.

Greasy applications of all kinds should be cautiously avoided in these cases.

In bruises, where the skin remains unbroken, the use of discutient saturnine camphorated washes is in general the most advisable.

Strains take place in different parts in the *shoulder*, they may often be removed by the application of camphorated preparations, as an embrocation composed of a pint of camphorated liniment, half a pint of opodeldoc, and four ounces of Barbadoes tar, well mixed together, and made use of two or three times a day, after bleeding from the plate vein.

When in the *knee*, *back-sinew* or *fetlock*, much advantage has been found from the application of a cold saturnine poultice to the part, and from a flannel roller passed round the leg, and kept constantly wet with a wash composed of two ounces of crude sal ammoniac, dissolved in a pint of vinegar, with two quarts of pure water, and two ounces of vinegar of lead.

Warble tumours, arising upon the backs or sides of horses, may be removed with facility by the use of salt and water, brandy, warm vinegar, or a wash composed of opodeldoc and spirits of turpentine in equal parts. Where the skin has been rubbed off, the compound tincture of myrrh may be useful. As tumours and bruises of this sort often arise from the saddle's not fitting perfectly, by which extraneous substances are insinuated, great care should be taken in this respect.

Colds, and complaints of that sort, may be best removed, when mild, by rest, and the use of mashes of bran two or three times a day; and, when more violent, by bleeding, and the giving of balls composed of calomel and antimonial powder, each one drachm; powdered nitre one ounce, and treacle sufficient for making them into a ball, which should be washed down with two or three pints of warm oatmeal gruel; the bowels being emptied by means of clysters. In giving these, it is necessary to have a large pipe, as much depends upon it. A powder formed of half a drachm of camphor, one scruple of antimonial powder, with one ounce each of nitre and aniseed, has likewise been found useful.

In colics, when of the spasmodic kind, advantage may often be derived from the use of balls composed of one ounce and a half of Venice turpentine and one drachm of purified opium, with two drachms of powdered ginger, the bowels being occasionally cleared by the use of clysters of gruel in the proportion of three or four quarts. Warm gruel, with bruised carraway-seeds boiled in it, may also be occasionally given with benefit.

The staggers is a disease that is frequently much relieved by bleed-



ing; after which, benefit may be produced by the giving of a ball formed of two drachms of calomel, with an ounce of aloes, and two drachms of powdered ginger, made up with honey. Strong clysters may also be had recourse to with benefit, and mashes of bran, oatmeal, or malt, be frequently made use of.

In the strangles, after taking away blood in proportion to the state of inflammation, advantage may be derived from the use of a powder constituted of one ounce of powdered nitre, a drachm of camphor, with half an ounce of powdered aniseed, given twice a day in a quart of gruel. The horse should be warmly clothed about the head, and mashes of bran and oatmeal be frequently given. Saturnine fomentations may be applied frequently warm, by means of flannels, to the tumefied glands; or a bran poultice may be equally effectual; and much relief may be afforded to the cough, and soreness of the throat, by having the horse to breathe through a nose-bag of scalded bran occasionally for a short time.

The yellows is a disorder very common in young horses, without being attended with fever: in these cases much relief is often afforded by a bolus composed of one ounce of powdered aloes, a drachm of calomel, and half an ounce of Venetian soap, given every second or third night. And a ball formed of half an ounce of nitre, with an equal quantity of powdered resin and common soap, may be employed with advantage in the intervening mornings. Mashes and warm water should be plentifully given, and the horse kept warm by clothing, as well as fully exercised.

Where worms prevail in horses, whatever the kind may be, great benefit may be produced by a powder composed of a drachm of calomel with half an ounce of powdered aniseed, given in the evening in a little treacle; and in the following morning a bolus formed of an ounce of aloes in powder, with two drachms of powdered ginger and a little treacle; or a powder formed of half an ounce of æthiops mineral, with an equal quantity of crude antimony and aniseed in powder. With these remedies there is little danger of the horse being injured by cold, or occasion for any alteration in his food.

In the botts, which are probably produced from the ova of a fly, deposited on the skin of the animal during the hot season, and thence licked in by the tongue, and taken into the stomach, where they are afterwards hatched, and adhere to the inner coat, the same method of treatment will be found useful as in the preceding case.

When horses are discovered to be affected with the glanders, they should be separated from the others and confined by themselves, and care taken that they have no sort of communication with the others by any means whatever, as the least thing possible will communicate the infection: the same remedies should then be made use of as in colds and strangles.

In the farcy, when the lymphatic swellings first present themselves about the legs, a blistering liniment well rubbed on the parts, as far as the disease extends, may often be found effectual in removing the disease. Bleeding, to the extent of three or four pints, may likewise be sometimes had recourse to in the early state of the disorder with



success. In the more inveterate state of the complaint, advantage has been found from the use of balls composed of one scruple of muriated quicksilver, with half a drachm of camphor, and the same quantity of purified opium, to which may be added half an ounce of crude antimony in powder, and two drachms of ginger in powder, with honey in proportion, to make them up into a ball. And another form, that is often beneficial, is that of ten grains of calcined mercury, with half a drachm of camphor and opium, and half an ounce of aniseed in powder, made up into a ball with treacle. Either of these balls may be given every other evening, with mashes two or three times in the day, to which occasionally a handful of malt may be added. The water in these cases should be given warm. Rowels may likewise be put in the chest and thighs when necessary. Cordials and a generous diet should be had recourse to, and warm clothing, with gentle exercise daily employed. When the disorder is removed, a ball composed of half an ounce of crude antimony, and the same quantity of sulphur and cream of tartar, with half a drachm of oil of aniseed, may be found very beneficial in restoring the animal.

The grease is a disorder that occurs frequently, and which is best removed by early attention. In well-fed horses bleeding may be useful to two or three quarts, either from the neck, or the thigh, when local bleeding is preferred. The hair should be closely cut from the affected part, which must be well washed with a strong solution of soap and water, after which a saturnine poultice may be applied warm twice in the day; and when the inflammation disappears, half an ounce of powdered alum may be added to each poultice, which should be continued for six or eight days. Warm mashes, with an ounce of nitre dissolved in each, should be given night and morning; and a ball, composed of half an ounce of nitre in powder, with an equal quantity of yellow resin and soap, common turpentine being employed to make them up, may be given once a week. Horses in this situation should have gentle exercise, with a generous diet, and plenty of stable room and clean litter. When the tumefaction subsides, pressure by woollen bandages may be found useful. In Lincolnshire, Mr. Cartwright found that common groundsel given to the horses in the stable cured greasy heels.

In the *mange*, after having the parts well washed with soft soap dissolved in water, they may be anointed with an ointment composed of four ounces of sulphur, and two ounces of strong mercurial ointment, with three ounces of hog's-lard, every other day; and a ball, formed of half an ounce of æthiops mineral, and an equal quantity of crude antimony and cream of tartar, given every night for some length of time. Great attention is necessary to diet, exercise, and good grooming. Mashes, with nitre dissolved in them, are also extremely useful in this complaint. When the disease disappears, the horses should be turned to grass if the season admits.



## SECTION XXIV.

*Live Stock.—Swine.—Rabbits.—Poultry, &c.*

THERE is another description of Live Stock, which, though not in general so much attended to by farmers, from its consisting, for the most part, of such animals as are of a much smaller size, may, under different circumstances and in many situations, be found to afford a considerable profit and advantage.

*Swine.* These are a sort of live stock that bring great profit to the farmer, when proper attention is bestowed in the breeding, rearing, and other management. The well-formed hog should not be too long, but full in the head and cheek, thick, and rather short in the neck; fine in the bone; thick, plump, and full in the carcass; full in the quarters, fine and thin in the hide, and of a full size in proportion to the kind, with a disposition to fatten well at an early age. The breeds of those animals are very numerous, as almost every district is in possession of a different sort. Of the larger kinds the most valuable breeds are probably the following:

The *Berkshire breed*, which is distinguished by being in general of a tawny or reddish colour; spotted with black; large ears hanging over the eyes; thick, close, and well made in the body; legs short; small in the bone; disposition to fatten quickly. This useful breed has extended itself from the districts which furnish its name over most parts of the island. It is the sort mostly fattened at the distilleries; it feeds to a great weight, and is good for either pork or bacon.

The *Hampshire breed* of hogs is very large, being longer in the body and neck, but not of so compact a form as the Berkshire; they are mostly of a white colour, and are well disposed to fatten, coming up to a great weight when properly managed.

The *Shropshire breed* is another large sort of hogs, which are found valuable where the keep is in sufficient abundance for their support. They are not however so well formed as those of the Berkshire kind, or equal to them in their disposition to fatten.

The *Gloucestershire breed* is likewise a large breed, but inferior to either of the above, being tall and long in shape, and by no means well formed. The colour is in general white. Mr. Marshall supposes this to have been formerly the prevailing breed of the island. It is supposed to be thinner in the skin than the Berkshire breed.

The *Herefordshire breed* is also a large useful breed, but without possessing any advantage over those that have been mentioned.

It is remarked by the author of the Survey of Middlesex, that the largest breed in the island is supposed to be kept about Rudge-



wick, on the borders of Sussex and Surry. They feed to an extraordinary size, and weigh at two years old nearly double or treble the usual weight of other sorts of hogs of that age. As large breeds pay the farmer the best in many cases, such a breed deserves to be attended to.

Among the smaller breeds of these animals there is much variety.

The *Chinese breed* is distinguished by the neck being thick, the body very close, compact, and well formed; the legs very short, and the size small; the flesh delicate; the colour various, as white, brown, black, and tawny. This breed is particularly disposed to fatten in an expeditious manner, and has, in consequence, spread over a great part of the kingdom. It is the most adapted for being used as pork, but is much too small for being cured as bacon.

Another breed of the small kind of hogs is met with in many districts; it is of a white colour, thick, compact, and well made in the body; short in the leg; the head and neck well formed, and the ears slouching a little downwards. It is well disposed to fatten, and perfectly hardy.

The *Swing-tailed breed* is an useful sort of the smaller kind of hogs, being hardy in its nature, and of considerable weight in proportion to its size.

Some farmers prefer mixed breeds, as being more beneficial than either the large or small perfect breeds. Where this is the case, the Berkshire, with a cross of the Chinese, has been found a very profitable sort, as being capable of feeding to a considerable weight with a moderate proportion of food. A sort kept by Mr. Western, in Essex, is likewise found valuable.

In order to have hogs of the most perfect kinds the same attention should be paid in the breeding of them as in other sorts of animals, by selecting the most perfect and best-formed males and females of the several breeds, and carefully raising the stock from them. Those intended to be kept as sows and boars should be constantly well fed from the first, as where they are pinched for food they are never so fine or healthy afterwards.

The breeds of hogs, like those of other animals, should be provided according to the nature of the keep. Where it is abundant, or cultivated solely for the purpose of the raising of pigs, the large breeds will mostly be found the most advantageous, as the difference in the proportions between the living and the dead profitable weight is said by some to be always the least in the largest-sized animals.

It is of the utmost importance, in the management of swine, both in the view of economy in the labour of their attendance, and the raising of a large proportion of manure, as well as the advantage of the hogs, to have convenient sties or piggeries. The methods of constructing these, with the greatest advantage in these different respects, have been described. It is remarked by Mr. Young, that a piggery "must be in a circle, or it must fail in convenience. In the centre, the boiling or steaming-house, with a granary for corn, meal, bran, &c.; a range of cisterns in divisions around it, for receiving food immediately from the copper or steam apparatus, and



*Northwestern Boar*









Weston's View



Weston's View







also by tubes from the dairy; around these a path, then the fence, wall, or paling, in which are fixed the troughs, with hanging lids, for supplying food directly from the cisterns on one side, and for the hogs feeding on the other; a range of yards next, and another, of low sheds beyond; and last of all, the receptacle for the dung. The potatoe stores (*pyes* as they are called) should be at one end or point near to the entrance, and water must be raised to the coppers and cisterns at once by a pump; a trough or other conveyance from the dairy to the cisterns, for milk, whey, &c. Such an arrangement will be very convenient, and the expense need not be considerable. To annex a certain space of grass, or artificial grasses, in divisions, into which the hogs may be let at pleasure, is an addition of admirable use if the spot permit it. Those who do not possess a convenient pig-apparatus can have little idea of the great use of it in making manure. This alone becomes an object that would justify any good farmer in going to a certain expense for attaining so profitable a part of what ought to be his farm yard system. In nine-tenths of the farmeries in the kingdom it is lamentable to see so many parts of a right piggery scattered and unconnected; in such a manner as to preclude convenience, increase labour, and prevent the making of dung. It is added that, “with such a convenience, all the pease, beans, barley, buckwheat, potatoes, parsnips, carrots, &c. that are or can be raised on a farm, may be applied to the rearing, feeding, or fattening hogs; by which means the farmer has the opportunity of improving his land to the highest degree, and at the cheapest rate possible.”

The sow is capable of propagating at seven or eight months old; but it is better to defer her taking the boar till ten or twelve months, as she becomes more strong, and affords better litters of pigs. The period of being with young in the sow is about four months, and the usual produce from about eight to ten or twelve in the large, and more in the smaller breeds, which in general bring the greatest number, and the most early. The boar should be a year old or more before he be put to the sows, as by this delay he attains a better growth, and is more vigorous.

As there is great difficulty and expense attending the rearing of young pigs in cold seasons, the farmer should contrive as much as possible to have his litters early in the spring and autumn seasons, as about the beginning of April, and the latter end of August, or beginning of the following month, as at these periods much less loss will be sustained in the death of the pigs, and less expense incurred in food. The litters which are pigged in June, or the early part of the following month, should always be reared, as being highly profitable. But it is seldom advisable to keep the late autumn litter, as the cold in the winter is almost sure to destroy many of them. When swine are made an object to the farmer, great care should be taken to have a good boar constantly along with the sows, in order that a proper succession of young pigs may be produced. By this means the sows are likewise induced to take the boar sooner than would otherwise be the case.



In the management of hogs it is of great consequence to keep the different sorts separate and distinct from each other, as the sows in pig, those with pigs, and the stores, according to their ages. It is only in this way that they can be kept to the most advantage. At the time of pigging it is necessary also that each sow should be kept in a separate stie, in order that there may be no interruption or disturbance from the others coming about her. About this period, likewise, more than ordinary attention should be bestowed on the sows, and the sties kept but thinly littered, in order that accidents may be avoided.

As the breeding of pigs is a business that affords the farmer a considerable advantage in various views, it is of essential importance that he be provided with suitable kinds of food in abundance for the support of the numerous sows that it will be necessary for him to keep, and the great number of pigs that must be raised. Upon this being properly and effectually done his success and advantage will in a great measure depend. The crops capable of being cultivated with the most benefit in this intention are beans, pease, barley, buck-wheat, potatoes, carrots, parsnips, Swedish turnips, cabbages, lettuces, clover, lucern, chicory, &c. The proportions in which these crops should be grown for this purpose must vary according to circumstances; as the kind of hogs, their extent, and the manner of disposing of them; but whatever number may be kept, an equal proportion of root crops, and those of the grass kind, will be requisite, with about half as much of those of the farinaceous or grain kind as of those of the root sort; and a quantity of the luxuriant vegetable kind, fully in proportion to the number of hogs that are to be fed on such sorts of food.

In the supplying of the hogs with food a distinction is likewise to be made according to the different kinds, in order that the most may be made of the food. The sows considerably advanced in pig, and those with pigs, should be fed in a better manner than the store pigs. The former should be supplied with good wash twice or oftener in the day, and have a sufficient allowance of cabbages, potatoes, carrots, or other similar vegetables, so as to keep them in good condition; which is shown by the gloss of their coats. The sows with pigs should be kept with their litters in separate sties, and be still better fed than those in pig. Where dairying is practised, the wash of that kind which has been preserved for the purpose while the dairying was at the height, in brick cisterns, constructed for receiving it from the dairy, must be given them, with food of the root kind, such as carrots, parsnips, potatoes, and cabbages, in as large proportions as they will consume them, in order that the pigs may be properly supported and kept in condition. But where the business of dairying is not carried on so as to provide wash of that sort, meal of some kind or other must be had recourse to for the making of wash, by mixing it with water, which in the summer season will be sufficient for their support; and in winter it must be blended with the different sorts of roots prepared by boiling, or, when for the young pigs, with oats and pea-soup. With this soup



and dairy-wash, where proper attention is bestowed, young pigs may be weaned and reared in the winter season even with profit and success. The pea-soup is an admirable article when given in this intention; it is prepared by boiling six pecks of peas in about sixty gallons of water, till they are well broken down and diffused in the fluid; it is then put into a tub or cistern for use. When dry food is given in combination with this, or of itself, Mr. Young advises oats, as being much better than any other sort of grain for young pigs, barley not answering nearly so well in this application. We have employed oats coarsely ground for young hogs with the best success, both in the form of wash with water and when made of a thicker consistence.

Where the sows and pigs can be supported with dairy-wash and roots in the manner just mentioned, there will be a considerable saving made by avoiding the use of barley-meal, pease, or bran and pollard. It is therefore highly disadvantageous to the farmer to have recourse to such substances in these circumstances.

There is another point to be particularly regarded in the management of sows and pigs, which is that of keeping them constantly well littered down with clean straw, or some other similar article, as by this means they are kept perfectly clean and healthy, and at the same time a large quantity of manure is afforded.

In the practice of cultivating crops of various kinds purposely for the food and support of swine, the sows and store-pigs will of course be supported during the winter season, as from the beginning of November to the middle or latter end of May, by the various roots that have been stored in this view, such as potatoes, carrots, parsnips, and Swedish turnips; also cabbages in their fresh state, in combination with the preserved dairy-wash, and other articles that have been noticed above. At the latter of the above periods the whole of the hogs in the yards should be looked over and sorted; such as have attained half or more of their growth being drawn and turned upon the clover, lucern, or chicory crops, where they should be kept till towards the latter end of September, the fences being kept in perfectly good order, and ponds or other places provided for the hogs to drink at. Under this management they are found to grow rapidly, the food in general agreeing well with them, and they are then taken up in excellent condition for being fattened. In this practice the important difference from the former method is in selecting the sufficiently grown hogs from the sows that have pigs and the weaned pigs, and only leaving the latter to be fed with the dairy or other wash, with suitable green food, such as lettuces, cabbages, tares, &c. by which a much larger stock of breeding hogs may be kept. The tares and cabbages may be used for the sows that have spring litters, and the lettuces for those that have autumn litters. The method of cultivating this plant in this intention has been already noticed.

These plants are of excellent use for sows and pigs, promoting the increase of milk in a great degree; they afford great assistance where the dairies are small, and in all cases tend to prevent the consumption of grain, which is of great importance in hog-management.



From the sweet and saccharine quality of the plant, the hogs are not only extremely fond of it, but it becomes highly nutritious. By these means the swine will be well supported and carried forward till the time the stubbles are cleared, when they may be turned upon them, and thus the whole year be provided for in these different ways.

But though this system of management is advantageous, that of soiling the hogs in the yards with green food, cut fresh in the way that has been already directed, is considered by Mr. Young, notwithstanding the increased expense that attends it, and the waste of a certain portion of the food, as highly preferable on account of the vast store of manure that may be raised. But it cannot be attempted with propriety unless the farmer be provided with abundance of some sort or other of materials for the purpose of litter, and substances of the peaty or earthy kinds for the purpose of covering the floors of the hog-yards, in order to absorb and prevent the waste of any portion of the liquid matters that may fall upon them. In this method of proceeding, clover, chicory, tares, and lucern, are the kinds of food that are most commonly employed; but there are others that may be brought into their assistance when necessary, especially on the stronger sorts of lands, such as beans eaten green, which afford a large quantity of food in proportion to the land they occupy, the whole stems being consumed, and cabbages may likewise be had recourse to for the summer as well as winter food of these animals. It is recommended by the same writer, that the yards of the hog-sties should have gates sufficiently large for bringing in carts loaded with the different articles of both food, floors, and litter, as well as for removing the manure that is made.

In this management, instead of a few sows only being kept, as was usual in combination with the dairy system, great numbers may be maintained, and a great many young pigs be raised. But in order to derive the greatest advantage from this system of hog-management, it should as much as possible be so contrived that the sows only pig twice in the year, as has been mentioned above; as by this means there will “never be a long and expensive season for rearing the pigs before they are put to the staple food of clover or potatoes, &c. But this circumstance is much removed by the provision of crops raised expressly for swine.”

In this scheme of keeping swine, the sales for lean hogs should annually take place in October, the litters of April being then disposed of as stores, and those of August kept till the same period in the following year, in order to be sold as baconers, when none are fattened on the farm.

The expense of keeping all sorts of store-swine must obviously vary considerably, according to the convenience of procuring their food, and the excellence of the management that is pursued. In suckling-sows it has been estimated upon the average at from eighteen pence to three shillings the week, and while in pig at from one shilling to eighteen pence; weaned pigs at first from one shilling and sixpence to two shillings and sixpence per head, and afterwards till they are become fully grown at from one to two shillings each



per week. Such calculations must, however, be liable to differ greatly in different cases.

The breeding of pigs is a system that deserves the farmer's attention, not only as obtaining his pig-stock at a much cheaper rate than by purchasing at the markets, but as being certain of having them more healthy and well fed, consequently such as will answer much better in their growth and fattening afterwards.

The fattening of hogs is a business usually performed at two different seasons of the year, as in October and in February or March: the former is, however, the most principal period. In this management various substances have been recommended; but those most commonly employed are some sort of farinaceous material, with skimmed milk, and dairy or other kinds of wash. For the smaller sorts of fattening hogs, coarsely ground oats, mixed with these washes, are excellent. Barley meal and pollard are likewise frequently made use of for the purpose with much success. The meals of pease and beans, when given in sufficient proportions for the purpose of fattening, are apt to heat them too much, and produce a difficulty of breathing; but for the larger or full grown hogs, pea meal, or pease unground, are probably the best material that can be made use of. A portion of bean meal, or whole beans, may likewise be given occasionally with advantage, as both these articles contain a much larger proportion of nutritious matter in the same bulk than any sort of grain, and are more lasting in their effects on the system, from their undergoing the process of digestion more slowly; perhaps, on account of their containing a larger proportion of oil in their composition. Malted barley given whole has likewise been highly beneficial in the fattening of hogs, the quantity of saccharine nutritious matter being thus greatly augmented. Acorns in the same state have likewise been found to fatten hogs, but they cannot be depended on as a food for this use. Potatoes and carrots have also been occasionally tried in the same application; but as they never answer well without being boiled, and combined with the meal of some sort of grain, it is a much better and more economical practice to convert them to the purpose of store-feeding, and depend upon farinaceous substances for fattening. There is another method of fattening, which in particular situations may be practised with profit and success, which is that of employing the wash of large distilleries with grains and some sort of meal. In the first part of the fattening the grains and wash are given, and in the latter the meal. In Essex, Mr. Pattison and Mr. Dunkin find, that their hogs fatten much faster in cases made so as to hold only one pig each without turning. In this way the pigs are more quiet, and sleep more. The food is barley-meal and water.

The quantity or weight of pork produced by a given quantity of pease, beans, meal, or other materials employed in the fattening of hogs, has not been well ascertained, and it is probable that a great deal will depend upon the size, breed, and disposition to fatten; but, judging from the value of the animals before and after they have been fattened, it is concluded by Mr. Knight, that a Winches-



ter bushel of the first of the above articles may add about nine or ten pounds to the weight of a good hog of twenty score, or perhaps something more upon a larger and considerable less on one of a small size. A hog put up to fatten in good condition, (and they should never be put up in the contrary state,) which, when fat will weigh twenty score, will consume in the proportion of six or seven bushels of pease.

It has been already suggested, as highly important in the fattening of animals, to have them occasionally weighed, in order to determine how the food answers with them, as well as to ascertain the progress they are making. For the large sorts of stock, machines of the nature of those used on roads are fixed up and employed, but for many small sorts of animals, such as sheep, hogs, and other similar kinds, one on the principle of the common steel-yard has been contrived, which is found to be perfectly convenient. It has a strong wooden frame, with steel centres, in which the pivots of the lever are hung, as seen in the plate at A A A A.

On the short side of the lever is suspended a coop, surrounded by strong net-work, in which the animal intended to be weighed is placed; the point of suspension is connected with the coop by means of two curved iron rods, which at the same time form the head to the same; a common scale is hung on the longer side of the lever. By this contrivance any small animal may be very easily and expeditiously weighed with a sufficient degree of accuracy.

In regard to the method of giving the different materials that are employed in the fattening of swine, there are different opinions entertained; some contending that they should be used as much as possible in a solid form, wash, as drink, being occasionally used; while others prefer the contrary method as the most beneficial: as in the latter mode there will be less time taken up by the hogs in feeding, and of course more left for them to sleep and rest in, as well as more economy in the food, and the labour of giving it, it is probably the most advisable. It has indeed been observed, that "the most profitable method of converting corn of any kind into food for hogs is to grind it into meal, and mix this with water in cisterns, in the proportion of five bushels of meal to one hundred gallons of water, stirring it well several times a day for three weeks in cold weather, or for a fortnight in a warmer season, by which it will have fermented well, and become acid; till which time it is not ready to give." This mixture should always "be stirred immediately before feeding," and "two or three cisterns should be kept fermenting in succession, that no necessity may occur of giving it not duly prepared. The difference in profit between feeding in this manner, and giving the grain whole or only ground, is so great, that whoever tries it once will not be apt to change it for the common methods." And that "pea-soup is an excellent food for hogs, and may, though they have not been sufficiently compared, equal the above, especially if given in winter, milk warm." But, wherever food is prepared by heat, the expenses of fuel and labour are a great drawback on the profits of the system. It should therefore be well considered before it is undertaken. But, in whatever way the food



be given, great care should be taken that the hogs have a full allowance at sufficiently short intervals to keep them constantly in a state of rest, as it is on this principle that they become fat in an expeditious manner. It is a fact frequently observed in fattening hogs, that they pay better for their keep in the latter part of their fattening than in the former; which probably arises in some measure from their not being fed in a sufficiently full manner, or with sufficient frequency in the beginning, so as to keep them in a state of rest.

The length of time that is necessary in fattening these animals must vary much according to the state in which they are put up, their sizes, and the differences in their dispositions to fatten; but in general from five or six weeks to two or three months is sufficient. In the time of fattening it is of great importance to keep the hogs clean and warm by having them frequently well littered down, as by this means they not only fatten more quickly, but the most manure possible is raised. The advantage of warm sties, with warm food in cold weather, has been found very considerable.

It is the best method to have the pigs castrated while young. The male pigs are usually gelded at about three weeks old without danger, and the female ones may be cut or spayed when a month old; though, in the latter case, the operation is frequently performed at a much later period. The sows, when not wanted for the purpose of breeding, may also be spayed: this business is mostly done by persons who are in the constant practice of it.

It is absolutely necessary to keep all sorts of swine constantly well ringed, in order that they may lie quietly in the sties, and of course thrive better.

A great mistake seems to have been committed by farmers in the management of hogs, from the supposition that they can only be kept with profit in so far as they may consume the materials that would otherwise be wasted. There cannot, however, be any doubt but that swine will pay for their keep as well as any other sort of live stock, where a judicious system of cultivating crops purposely for them is pursued.

There are different ways of curing the flesh of hogs, according to the intention for which it is designed. When cured as bacon, it is the practice in Kent to singe off the hairs, by making a straw fire round the hog, an operation which is termed *swaling*. "When the flitches are cut out they should be rubbed effectually with a mixture of common salt and saltpetre, and afterwards laid in a trough, where they are to continue three weeks or a month, according to their size, keeping them frequently turned; and being then taken out of the trough are to be dried by a slack fire, which will take up an equal portion of time with the former; after which they are to be hanged up, or thrown upon a rack, there to remain till wanted."

In the making of bacon on the continent it is frequently the custom to have closets contrived in the chimneys, for the purpose of drying and smoking them by means of wood fires.

Another method of curing this sort of meat is that of salting it down for pickled pork, which is far more profitable than bacon.



After the hog is cleansed of the hair, and the head taken off, together with the legs and hands, and the necks, loins, and all the lean bones cut out, which will amount to nearly two-thirds of the whole hog, the remaining part, which is the fat or prime pork, is to be cut into pieces of a size proportioned to the circumference of the salting-tub, and every piece rubbed on each side and on every part with common salt, having some beaten saltpetre sprinkled on each. The bottom of the tub should also be covered with salt, and when the pork is sufficiently powdered, the pieces laid in, with the rind upwards, and every one pressed down with all the strength that can be used, and wedged in so close as to leave no apparent chasms. Over this layer is to be spread a covering of salt, with a very slight sprinkling of saltpetre, as too much makes it hard. In about a month or five weeks the brine will begin to rise, and, in a short time afterwards, cover the whole surface of the tub; but if, from a defect in the salt, it should fail to dissolve into brine within that period, it will be necessary to make a quantity of brine and pour over the pork; for unless the whole be covered with brine it will not keep well. In adding the brine care should be taken not to disturb the pieces of pork.

In the curing of hams in Westmoreland, the method pursued is this: They “are first rubbed very hard, generally with bay-salt; by some they are covered close up, by others they are left on a stone bench to allow the brine to run off. At the end of five days they are again rubbed as hard as they were at first, with salt of the same sort, mixed with rather more than an ounce of saltpetre to a ham. Having lain about a week, either on a stone bench, or in hogsheads amongst the brine, they are hung up by some in the chimney amidst the smoke, whether of peats or coals; by others, in places where no smoke ever reaches them. If not sold sooner they are suffered to remain there till the weather becomes warm. They are then packed in hogsheads with straw or oatmeal seeds, and sent to the places of sale. It has been found by experiment that hams lose twenty per cent. of their weight in the curing.”

Swine are subject to a variety of diseases, but few of them have yet been sufficiently investigated to ascertain the proper means of cure. Much exposure to cold is liable to bring on affections of the lungs, by which the animals gradually decline, and waste in the flesh, having a frequent husky dry sort of cough. Warmth, with good keep of the less dry and heating kinds, would seem to be the most advantageous method of removing such complaints.

When hogs become affected with the mange care must be taken to separate them from the rest; and after being well washed in soap and water, they should be anointed with an ointment of the same kind as that recommended for the same disease in sheep. A little common sulphur should likewise be given in their food.

In large lop-eared hogs the parts behind them are apt to crack and become sore in hot seasons; in these cases they should be anointed with a little saturnine ointment.

When the udders of the sows take on hard lymphatic swellings, which is sometimes the case, attempts may be made to remove



them by the use of camphorated saturnine washes or ointments, care being taken to have the parts clean wiped before the pigs are admitted to suck. In such cases half a drachm of calomel may likewise be exhibited every second or third night for two or three nights.

*Rabbits.*—This is a kind of live stock that can only be employed with profit by the farmer in particular situations, and under certain circumstances. Wherever land is capable of producing tolerable crops of either grain or grass, the system of rabbit-warrens can seldom, if ever, be established with advantage. The hazard and uncertainty of rabbit-management is constantly so great, that it is safer for the farmer to depend upon even moderate crops of either of the above kinds than this. It is only the light, barren, sandy sorts of land, in such declivities and other situations as cannot be brought under the plough, and which cannot be converted to the purpose of pasture even for sheep, which is in general the proper application of such lands, that rabbit-husbandry is proper to be undertaken upon.

The breeds of this animal are various; but those chiefly employed in warrens are mostly either the *common gray breed* or the *silver-gray breed*; the former is most valuable in regard to hardiness and flesh, but the latter in respect to skin. The fur of the first sort, which is the most prevalent, is chiefly employed in the hat-manufactories, while the skins in the latter cases are in common dressed as furs for the China market, and are in general nearly double the value of those of the other sort.

This sort of stock, when turned into the land intended for the warren, soon provide themselves habitations, by preparing holes and burrowing in the more dry, light, sandy, and elevated parts, where they safely lodge and propagate their young. In some warrens in Lincolnshire they stock in the proportion of three couple to the acre, but in other cases considerably more. One buck is sufficient for a hundred does. It is necessary to have the warrens well inclosed; not only for the purpose of preventing the stock from straying and being destroyed, but to prevent their being annoyed by different sorts of vermin. This is effected in different methods, according to circumstances, as by walls or paling; but, from the great expense of these fences, more commonly by sod, earth, and turf mounds, or banks and fences coped, or kidded on the top by furze, thorns, or other sorts of brush-wood. This fencing, with that of nets and traps, constitutes the great expense of rabbit-husbandry; which, when added to those of charcoal for drying the skins, warreners, men for killing and carrying, horse-hire, &c. is very considerable.

Besides this, though rabbit-stock demands, on the whole, but little regard, in severe winter seasons it is necessary to provide them with additional food, such as hay, turnips, clover, saintfoin, and other similar kinds, to be dispersed about in the warrens. Turnips are the best sort of food in snows, as the rabbits can find them by the scent. From two to three large cartful will be sufficient to fodder a thousand couple or more a day. One load of hay may be suffi-



cient for a day in storms. In some districts, billets of new cut wood, ash boughs, gorse, &c. are distributed; the bark and other parts of which are consumed, and the quantity of hay by that means greatly diminished. There are likewise other expenses, in clearing away snow from the fences, to prevent their escaping, and in the destroying vermin, as well as for night-watching.

The rabbit begins to breed at eight, ten, and twelve months old, and goes about thirty days with young, which are about twenty-two days more before they appear from the burrows, being suckled during that time twice a day by the mother; of course they may breed three or four times in the course of the year, when very well fed, as they are known to take the buck again very soon; but in inclosed warrens they rarely breed more than twice in the year. The annual sale of produce is in general estimated at from three to eight couple per acre, affording a profit of eight or ten shillings, or more, under good management. The produce is the greatest on new land; but much in respect to profit must depend upon situation, as when it is near large towns, where there is a constant demand for the rabbits as food, it must be greater than in other cases. They are in season from the beginning of November till the commencement of the ensuing year, during which period the prime skins are afforded; therefore the greatest part must be killed in this short interval. There is annually a great loss in what are termed *half skins*, *quarter skins*, and *racks*, sixteen of which are only allowed for as one whole skin. Rabbits are sold by the hundred, six score couple making the hundred.

They are taken either by means of nets or traps. In the former method the nets are set in the form of a fold, between the burrowing places and the feeding grounds, in the night or early in the morning; the rabbits being hunted into them in their return from feeding. The traps are constructed by forming large pits dug in the way of their most frequented tracks, and covered by a sort of folding door, towards the centre of which is a sort of small trap-door, to which they are led by a narrow track or meuse. The rabbits, being thus taken, are sorted according to circumstances.

A very great objection to these animals is their destroying the corn, new-sown grasses, turnips, and even the quick hedges in the vicinity of them.

In raising tame rabbits the principal points to be regarded are those of having such stock as is perfectly free from disease, keeping them quite clean, dry, and free from all sorts of filth, with a sufficient protection from cold in severe weather. The feeding should be performed regularly, in small quantities at a time, and due proportion kept up between the dry and moist green vegetable food: the most proper kinds of each sort of which are those of clover, parsley, endive, dandelion, cabbage-leaves, carrot-tops, &c. with good green rouen or clover-hay, pea-chaff, oats, pollard, and bran. They usually breed at the age of six months, and mostly three or four times in the year, especially when kept sufficiently warm in the winter season; at this time a little dry hay should be placed in the hutch, the young may be weaned at six or eight weeks old, and the buck admitted. The young rabbits ought to be carefully sepa-



rated when they become of any size, and never be suffered to be in any degree crowded together, as in such cases they soon become diseased.

*Poultry.*—This is a species of stock which, from the trouble and uncertainty that attends it, is of doubtful advantage, except in particular situations and circumstances. The term poultry comprehends several different sorts of birds that have been considered as stock for the farm-yard.

*Common Fowls.*—Of these there are various breeds, as the *game breed*, the *English* or *white breed*, the *Poland* or *black breed*, the *Darking breed*, the *Shagbag breed*, the *Malay breed*. The two first of these breeds are much smaller than the others. As this sort of stock, when under a proper system of management, affords advantage both in the eggs and chickens, it may be necessary to observe that the game and Poland breeds are in general the best layers, but that in respect to the size of the eggs the larger breeds are preferable. As sitting and breeding fowls, the Darking and other large breeds are probably the best; but in what regards the colour, quality, and flavour of the flesh, the game and the white breeds are supposed by those who indulge in this sort of food to be the most delicate.

In the management of poultry much depends upon proper conveniences being provided for them. The method of constructing houses for this use has been already described. In order that there may be the least possible interruption to the poultry, it is necessary that separate places be provided for the purposes of their roosting, sitting, and being fattened in, as well as for containing their food; and, where the quantity kept is very considerable, for plucking and preserving their feathers in; as by this means the system may be conducted to the greatest advantage. And where an attendant is kept for the purpose of feeding and taking care of this sort of stock, it may be of consequence to have the place which is designed for lodging in so situated, as that the smoke which it affords may pass through the roosting and sitting-rooms, as it has been long known that the smoke, as well as warmth thus communicated, is particularly grateful to the poultry, and highly promotes their breeding and thriving. This is sufficiently shown by the vast quantities that are raised in the warm smoky cottages in Scotland and Ireland.

In addition, there should also be the conveniences of a yard, in which they may pick up sandy or gravelly particles, with a small grass paddock for ranging in, in which there must be a supply of pure water. The whole of the internal parts should be kept perfectly clean and free from vermin, by being frequently washed out and lime whited.

In setting both the hen and the turkey, in order to prevent their inconveniencing each other, separate nests should be provided in situations where they can be confined and kept from the rest, as without this precaution the same nest will have two or three upon it; by which much injury may be sustained.

Hens may be kept in the proportion of about six or seven to a cock. Young ones are the best where eggs are the principal object;



but where chickens are chiefly in demand the older kinds should be preferred, as they sit with more assiduity and closeness. Young hens mostly begin to lay in January, or early in the following month; but this may be greatly promoted by the use of food of the more stimulant kind given with grain, as buck-wheat, barley, hemp-seed, fenugreek, &c. in which intention any kind of refuse animal matter, chopped very small, has been found highly beneficial, also any of the small sorts of fish, such as sprats, &c. prepared in the same manner. But whatever sort of food may be employed for the laying hens, it is essential to their producing a great number of eggs that they be not too much fed, though they should not be kept too poorly, as from each extreme disadvantage may proceed.

The periods of setting hens must necessarily vary according as chickens are wanted, but in general the latter end of February or the beginning of the following month is a good season for the purpose; as the weather will be getting warm about the time they are hatched. The period of sitting is usually about twenty-one days.

In setting the hens the eggs should always be such as are new laid, and perfectly fresh, and the number should not exceed a dozen. While sitting, the hens should constantly have a sufficiency of food near them, in order that they need not be taken from their nests too great a length of time. In the time of hatching some advise the removing the first brought-out chickens; but it is probably a better practice to let them remain, to be supported by the natural warmth of the hen until the whole brood is out. At this time some recommend their being put under a coop with the hen; but where the poultry yards are well inclosed they may be suffered to follow the mother. Where there are more broods than one the coops should not be placed too near each other, lest the hens should destroy each other's chickens. It is best to feed the chickens first with steeped rice, or split grits, with boiled potatoes bruised; but afterwards the refuse wheat or barley may be given them with propriety, after having been boiled or steeped some time in water.

The proportions in which these sorts of food are consumed by young chickens vary according to their size; but in general it may be reckoned from one to two ounces per day, while they are in the early part of their growth, as from half a pound to two and a half pounds weight or more. In about ten or twelve weeks chickens mostly become pretty full grown. It is necessary to prevent young chickens as much as possible from picking up slugs, snails, and other similar animals from the ground, and also to keep them as free as possible from the wet, as by these means they are extremely liable to become diseased.

Various directions have been given for the fattening of poultry; but the best practice is probably that of confining them for a few days in dry well-ventilated places, which are covered so as in some measure to prevent the entrance of too much light, the fowls being previously kept in good condition in the poultry yards. In these situations they should be regularly fed three or four times in the



course of the day with well-steamed potatoes, which are probably the cheapest sort of food: as near Liverpool, in Mr. Wakefield's practice; which was upon an extensive scale, it was attended with the most complete success, the poultry thriving perfectly well. Buck-wheat is likewise an useful and cheap food for this purpose, either given whole or ground into flour. Barley meal, ground malt, and also coarse wheat-flour, when mixed up with milk, or, what is better, water, as milk runs quickly into a state of acidity, have been much recommended in this intention. From some experiments, we are likewise inclined to believe that pea-meal employed in the same way possesses a still more fattening property, and is at the same time more economical, as going much further. A confinement of seven or eight days in this way will in general be sufficient for effecting this business of fattening. When kept up long, fowls are extremely apt to be affected with disease. Whatever sort of food is made use of, free air and a perfect state of cleanness is essential in all the utensils employed for the purpose, in order to prevent the food becoming acid, and the fowls affected with disease.

Mr. Young states the following farming system for poultry, as practised by Mrs. Boys of Kent: "The labourers' wives and families who live on Mr. Boys's farm do the whole; he supplies them with what offal corn is necessary, and they return Mrs. Boys the grown fowls ready for market at three-pence each; six-pence for turkeys and geese, and three-pence for ducks; and her account, well kept, states, he says, a profit of twenty pounds a year, after all expenses are paid and the family well supplied." She has also "all the eggs without any payment." It is remarked, that this system of practice is equally beneficial to the people who undertake it as the farmer. The climate and soil are there both highly favourable to the raising of poultry.

Fowls are liable to be affected with many different diseases, but the most common ones are the following:

The *Pip*, which is distinguished by a thin white scale being seated upon the tip of the tongue; and it is supposed to be produced by the fowls not being kept sufficiently clean, or the food and water being taken in a foul condition.

The best remedy is the removal of the scale, and the washing of the part with a weak solution of common salt in pure water.

The *Roup* is shown by the rump becoming swelled and enlarged, the feathers standing awkwardly out, and the quills being full of blood. The cure is best effected by removing the feathers, and then in slight cases using a weak saturnine wash; but where there is much swelling the parts should be opened and the contents discharged.

The *Flux* is shown by the fowls becoming suddenly thin and lean, and their not eating as usual. It is mostly caused by the use of too large a portion of moist fermenting food; or such as has run into the state of acidity. It is best removed by the giving of rice dry, and wheat unground; the coop or other place in which they are confined being kept perfectly clean and well aired.



*Stoppages* are often produced in fowls by their picking up different sorts of indissoluble substances; such as old mortar, &c.: when in the crop they may be taken out by making a small opening externally.

*Blindness* in fowls is best removed by changing their food, and letting them have more fresh air.

*Galena or Guinea Fowl.*—This is a kind of fowl that lays a great number of eggs; but probably retains too much of its wild nature to be kept with advantage by the farmer. The least disturbance makes it forsake its nest, which is mostly made in some distant unfrequented situation. The flesh of this sort of fowl is somewhat dry, but has more of the game flavour than that of the common fowl.

*Turkey.*—In grain districts, this is a bird that may perhaps be raised with advantage by the farmer; it is however very delicate and tender, requiring much attention and management while young. There are two breeds or varieties of this bird, the *black breed*, and the *white or speckled breed*: the former is in general the largest and most hardy.

These birds differ from others in not requiring the males to be constantly with the females during the laying season, as in Norfolk it is a practice to send the hen turkeys to some neighbouring cock to be impregnated, one act being found sufficient for a brood. By this means there is a considerable saving, in not having cocks to keep the whole year round; and of course most little farmers raise this sort of poultry, which is supposed a principal cause of their being so plentiful in that district.

The turkey mostly lays from eight to ten or twelve eggs, and hatches in about twenty-eight or thirty days. These birds are sometimes hatched under hens, as being more tame and less disposed to wander abroad with the young ones. The young brood are extremely tender, and require constant care and attention for a month or six weeks after they are hatched to rear them with safety. They should during this time be kept in a warm airy inclosed situation, perfectly free from wet, and be attentively fed with white bread steeped in milk that is quite free from acidity; or, what some prefer, alum curd mixed with chopped onions, for which use a proper supply of early young onions should be provided, or old ones planted in this intention. After they have been managed in this way for about a month, they may be brought gradually to be supported on oatmeal and sweet milk, or grain, of which buck-wheat is found the most suitable. As the expense in grain and trouble in rearing these birds is very considerable, from their being greedy feeders, without great success in raising them, and a certainty of high prices at the market, they can seldom repay the farmer.

Young turkeys may be fattened with great expedition by means of boiled potatoes and good barley-meal mixed well together, if they be kept fed in a regular manner. The practice of cramming them is a piece of stupid and unnecessary cruelty, as it is evident they can only fatten in proportion to the quantity of food that is digested, whatever quantity may be forced upon them; besides,



they will consume it fast enough without forcing, if kept regularly fed and properly supplied with a due quantity of some sandy or gravelly material. A small proportion of chopped leeks mixed with their other food has also a good effect in promoting the process of fattening.

Mr. Kent ascribes the fineness of the flavour in the Norfolk turkeys to the great dryness of the soil in that district, and the extensiveness of the range which they are suffered to possess.

The difference between the living and dead weight of a turkey is thus stated by Mr. Young:—Live weight 21lb.; dead weight 14lb.

*Water-fowl.*—Various birds of this description may be kept with benefit by the farmer, where he is so situated in respect to water, commons, and other conveniences, that they can be managed without much attention or trouble; but in other cases they are not worth his notice, as they will seldom repay the trouble of looking after them.

*Ducks.*—There are different breeds of ducks, but the common *white* or *English breed* and the dark brown or speckled *wild breed* are in most estimation. The flesh of the latter is higher flavoured than the former. These birds may be kept with most profit to the farmer in situations where there are large ponds or sheets of water for them to rest upon near to the farm-yards, as in such cases they will require little or no trouble; but in other circumstances, except where they are reared by persons who make a business of dealing in these and other sorts of poultry, they will afford little advantage in his way of profit, unless it be a few just for the purpose of the table. Ducks mostly begin to lay early in the year, as the latter end of January, or beginning of the following month, especially when well fed. They require attention at this period, as they lay a great number of eggs, and are very apt to drop them in the water, or at random in other places. One drake is sufficient for four or five ducks. When set, from ten to a dozen or thirteen eggs are a sufficient number. They sit about thirty days, and during the time should be fed and have water near their nests, to prevent the eggs from being injured by their leaving them too long. When hatched, they should remain with the duck in some inclosed safe warm sunny place, and be well fed with crumbs of bread, grits, or barley-meal and boiled potatoes well mixed and used fresh and fresh, sand and clean water being constantly kept in shallow pans. The duck breeders have also in general a provision of worms, snails, and other similar animals in readiness for them when a little more advanced in their growth, as well as corn either in its ground or natural state. It is likewise a point of great importance to keep them perfectly clean, and to let them have plenty of clean dry straw as litter. The practice of raising ducks under hens seldom answers well, as their habits are by no means suited to the rearing of such birds; nor has the custom of the trimming off the tails of the young ducklings any better foundation in reason. They should never be admitted at full liberty till they are become quite strong, as at a month or six weeks old. It is useful to keep them as distinct as possible from the others.



Ducks are greedy feeders, but not nice in the kinds of food. In the fattening of them, grain either in its whole or reduced mixed state is probably the best sort of food. The use of boiled potatoes well mixed with oatmeal is found to be an economical and expeditious method. Much, however, depends on their being fed in an exact and regular manner, and on a proper supply of water and sand being constantly given; while at the same time they are kept in a perfectly quiet detached situation, not too much exposed to the action of light, but well aired. When fattened on animal substances, which are very expeditious in accomplishing the business, they are said to have more resemblance, both in the colour and flavour of their flesh, to the wild duck, than in the common method. In the acorn-season they are also capable of being readily fattened on that sort of food, and are allowed to be well-flavoured in their flesh from it.

The establishing of *decoys* for taking of *wild-ducks* is an object of some importance in particular situations, as where there are extensive sheets of water in sequestered districts at no great distance from the sea, as in the wilds of Lincolnshire, Norfolk, and other counties. Much nicety and exactness are however requisite in the construction and management of these, in order to render them effectual, as may be seen in Mr. Marshall's excellent description of the means of forming them in the first volume of the *Rural Economy of Norfolk*.

*Geese.*—There are several distinct breeds of geese kept in different places; but the largest and most useful sort, whether for the purpose of food or feathers, is the *common breed*.

In the choice of store-geese, great care should always be taken to procure them as large in size as possible, and from places where they have been well kept. Geese, like most other birds, begin to lay in the spring months; and the earlier this happens the better, as the price of early green geese is generally high, and in some cases it may be possible to have a second brood. Both these purposes may be promoted by letting them be well fed with oats, grains, or some such kinds of food at the period. The goose generally lays from eight to twelve eggs. It may be known when geese are about to lay, from straw being frequently picked up and carried about by them. The length of time of sitting is about thirty days. When geese are inclined to sit, they generally shew it by remaining on their nest after laying a considerable time. In this case, a proper quantity of eggs, as from ten to twelve, should be placed in the nests, and something put before them, so as to prevent the geese from being much seen. They should also have plenty of food, sand, and water near them, in order that they may not have to remain long off the nests, and in that way let the eggs be too much cooled. The ganders should be left with them as guards. When the weather is warm they generally hatch rather sooner than when it is cold. After the goslings are hatched, the best method is to let them remain with the goose, especially where they are strong, in some warm sunny place, that is well secured against the entrance of rats, and all other sorts of vermin, and which is properly supplied with water; being well



fed with the crumbs of bread, grits, wheat, and some chopped clivers. They should remain in this confinement until they are grown strong and capable of following the goose with ease; they may then be put into a small field, or paddock, where the grass is short, till they are fit to be turned out with the geese. When they are weakly it is customary to feed them in the house with bread soaked in milk, or a little barley-meal, &c. Where this is done, they should however always be put under the goose again immediately after such feeding and handled as little as possible, warmth in this stage being the most essential, article in rearing them. They should never be suffered while very young to go into the water, as the cold soon destroys them.

Where the raising of these birds is an object, care must always be taken to have good ganders, which are neither too young nor too old, and that the eggs when laid be turned occasionally, and carefully kept in a dry and rather warm place. The numbers of geese to a gander should not be too great: three or four are quite sufficient.

The practice in Lincolnshire, where vast numbers of these birds are annually produced, is for their nests to be made for them of straw, and confined so as that the eggs cannot roll out when the geese turn them, which they do every day. When near hatching, the shell is broken a little against the beak or nib of the gosling, to give air, or to enable it to receive strength to throw off the shell at a proper time.

The time of plucking them is about the beginning of April; when the fine feathers of their breasts and backs should be gently and carefully plucked: care must be taken not to pull or interrupt their down or pen feathers.

The quills should be pulled five out of a wing. They will bear pulling in thirteen or fourteen weeks again, or twice in a year: the feathers three times a year of the old geese and ganders, seven weeks from each pulling. The young geese may be pulled once at thirteen or fourteen weeks old, but not quilled, being hatched in March. But when late in hatching, the brood geese should not be plucked so soon as April, but the month after. When well-fed with barley and oats, they thrive and do better, and their feathers grow faster and are better in quality than where it is omitted. They must constantly have plenty of grass and water.

In many parts of this fenny district vast advantage is made by the frequent plucking of the geese. At Pichbeck it is the practice to pluck them five times in the year, as at Lady-day, Midsummer, Lammas, Michaelmas, and Martinmas. The feathers of a dead goose are worth 6*d.* three giving a pound. But plucking alive does not yield more than 3*d.* a head per annum. Some wing them only every quarter, taking ten feathers from each goose, which sell at 5*s.* a thousand. Plucked geese pay in feathers 1*s.* a head in Wildmore Fen.

In the fattening of *green* geese, care should be taken that a little green food be given them along with the oats or other grain that may be employed for the purpose when they are put up, and that they



be well supplied with water and sand. A fortnight or three weeks is long enough for this purpose, if they be well and regularly fed; but, in the fattening of the older geese, there will not be any necessity for the green food. The place in which they are confined with this view should neither be too light, nor too public in its situation, as they do not feed so well where these points are not attended to. They should likewise be at a distance, so as to be out of the hearing of the old or store-geese.

Besides the benefits that may be derived from geese in the feathers and the birds as food, it seems not improbable but that they might be made to produce a considerable advantage in the way of manure, if managed under a system of constant littering with straw, fern, or some other substance of the same kind, as from the great quantity of grass they consume the discharge in the night is very considerable.

*Pigeons.*—Though pigeon-houses are common on many farms, it is in very few instances, probably, that this kind of stock, when the various disadvantages of it are considered, can be converted to much profit by the farmer. It is well remarked by an intelligent cultivator, that “the increase of pigeons beyond a certain degree must doubtless be injurious to the cultivation of grain: within due bounds, they do little harm, but increased beyond it, they prove pernicious vermin both to the new-sown crops and the early part of harvest. They are particularly voracious in early peas; therefore the advantage arising from their increase for consumption as food is more than counterbalanced by the mischief occasioned by their depredations.” And in Norfolk, pigeons are much fewer than formerly, as many of the pigeon-houses have been dropped, on account of the injury which the pigeons do to thatched buildings. The same is the case in Kent and other counties. They are particularly injurious to the grain crops just at the time of harvest, by settling in large flights upon the standing corn, and in this way doing more mischief by beating it down than by the quantity they consume.

Where this sort of stock is kept, warm sheltered situations, open to the south, are the most advantageous, as the pigeon delights in warmth, and being exposed to the influence of the sun. It is also of importance in the economy of these birds that the floor of the dovecote be nearly upon a level with the holes where they enter, and that these holes be not too large or too numerous; the holes where they form their nests should not be much inclosed, as pigeons delight in being at liberty. Salt and strong scents, such as that of assafoetida, are said to be agreeable to these birds, so as frequently to attach them to their habitations.

The pigeon seldom lays more than two eggs at one laying, sitting about twenty days, the male and female alternately. They are capable of breeding frequently, but in general produce only two or three broods or flights in the year. There are several sorts, but the common blue pigeon is probably the most productive. The tumblers are small, but very domestic.

After recommending the harvest flight of pigeons as the most proper for the purpose of stock, as being the strongest to withstand



the winter season, the author of the “*Experienced Farmer*” gives the following directions on the management of these birds. in regard to feeding them, it is advised as only necessary during the season between seed-time and harvest, when “it should be done by three or four o’clock in the morning: as they rise early. If you serve them much later, they will keep hovering about home, and be prevented taking their necessary exercise.” If fed “the year round, they will not breed near so well as if forced to seek their own food; for they pick up in the fields what is pleasant and healthy to them, and from the beginning of the harvest to the end of seed-time they find plenty.” They may be fed with tares, grains, or seeds of any kind.

“Be cautious of not letting the first flight fly to increase the flock, but let every one of them be taken; as these will come in what is called benting-time, that is, between seed-time and harvest. It is then that pigeons are the scarcest, and many of the young ones would pine to death through weakness during that season.

“At the latter end of every flight care should be taken to destroy all those eggs which were not layed in a proper time. The proper time for the spring flight is in April and May. After the harvest flight, cold weather begins to come on, which injures the old pigeon much if she sits late; and the young will be good for nothing if hatched.”

“It is very necessary to pay attention to cleanliness in the management of a dove-cote. Before breeding-time the holes ought to be carefully examined and cleaned; for if any of the young die in the holes in summer, maggots are soon bred in them; they become putrid, and emit a disagreeable and unwholesome stench, very injurious to the inhabitants of the dove-cote. Pigeons are tenacious of their nests, as appears from the conduct of the wood-pigeon, which will breed for years in the same tree, and the mother forsakes her nest with regret; but, unable to endure the filth and stench of her dead offspring, she is obliged to quit the eggs she has laid for a second brood, and the prime of the season is lost. Every summer, immediately after the first flight, the nests should be all cleaned out, and the dung totally taken away, as it breeds filth. But remember to do this business early in the morning.” The remaining eggs ought likewise to be destroyed, and a perfectly clean habitation made for the harvest-flight.

It is advised “never to go into a dove-cote later than mid-day, but as early in a morning as convenient. Whatever repairs are necessary, either to the building or to the nests, should be done before noon: for if you disturb the pigeons in the afternoon, they will not rest contentedly the whole night; and the greatest part, perhaps, will not enter the cote until the next day, but will sit moping on the ground; and, if in breeding-time, either a number of eggs may be spoiled, or several young ones starved to death.”

Pigeons are supposed to be more productive from the breeds being crossed; in proof of which a few tame pigeons were put into a dove-cote, and the consequence was, that a more early and a more



numerous hatch of young were produced than in any of the neighbouring cotes.

These birds have a great antipathy to owls, which find their way sometimes into dove-cotes; and there is no getting rid of such troublesome guests but by destroying them. "Rats are terrible enemies to pigeons, and will soon destroy a whole dove-cote. Cats, weasels, and squirrels will do the same. It will be necessary, therefore, to examine the dove-cote once every week at least, very minutely," to see that there are none of these intruders.

Pigeons "make an extraordinary good manure, which, if worked up into a compost, instead of being used in the present slovenly way, would be of still more value."

*Bees.*—How far these industrious insects may be kept as a part of the farming-stock with profit has not yet been fully shewn; but as they require little trouble, and there is in most country situations a sufficiency of food ready provided for their support, there can be little risk in the farmer making the trial, especially as the capital required will be but trifling.

In undertaking this sort of stock, the best situation is in general where the hives will be least exposed to wind, and enjoy as much of the influence of the sun as possible; for wind always retards bees in their work, while the sun's influence invites them to it. Though it is well known bees thrive well in high and windy situations, a low one is always to be preferred. Mr. Bonner advises "an early situation; a hollow glen by the side of a rivulet, surrounded with abundance of turnips in blossom in the spring, mustard and clover in the summer, and heath in the latter end of summer and harvest, with a variety of other garden and wild flowers in their seasons." It is an observation as old as Columella, that the bee-garden should constantly face the south, and be placed in a warm valley near a stream.

It has been well remarked, that "a plentiful assortment of bee-flowers is a consideration that requires attention, if we design to favour an ample production of honey. The nearer the pasturage is to the apiary, the more journeys the bees can make in a day, and consequently the sooner they will be able to fill their hives. The product from a large supply, but at a small distance, and in a temperate situation, even with the common management, will be superior to that of the most skilful in a bad one. On the contrary, with bad management, and with scanty pasturage and indifferent situation, a very trifling profit can be expected."

In respect to stands, the best arrangement is probably that of separate ones for each hive, made by driving four strong stakes into the ground, at equal distances, as thus ::, corresponding to the dimensions of the hive-floors, to rest on: they should be sixteen inches above the earth, and the tops upon a level with each other; the distance three or four feet from each other, and not too many together.

In purchasing stock-bees the "best time is just before the taking-up season, which is generally about the latter end of August; for



then bee-keepers reserve as many of the best stocks as they judge expedient for their next summer's supply, and therefore, after that period, are not disposed to part with any unless at an advanced price ; whereas, by purchasing some time before, a choice may be made of the best, and at the accustomed rate. They should be selected by a skilful person in a cool evening, or rather morning very early. By tapping about the hive a pretty near guess may be formed whether or not it is full of bees, as also if full of combs. But for greater certainty, turn those that seem heavy upon the edge of the hive, and observe if the interstices between the combs are crowded with bees, and the combs worked down to the floor. If white, or if a light yellow, it denotes their being of the present year's produce, and fit for the purpose ; but if they are of a very deep yellow or brown they are of the last season, and not so proper ; while those that are dingy or blackish are old, and wholly unfit to furnish a prosperous apiary. But though a hive may have the hedges of the combs of a light yellow, they may be old stocks, whose combs the preceding year not having been completed, have in the present had new borders added to them of virgin wax, so as to look like young stocks. Look carefully between the combs, as far as the bees will admit ; and if the interior parts appear favourable form a judgment accordingly. The hive should be poised in the hand ; and if it be about half bushel size, and weigh twenty-five pounds or upwards, it is another test of its being a good stock."

The " removing of stocks should take place in the evening, or very early in the morning. The hive should be raised by three or four wedges, some hours before, provided the floor is not moveable : or otherwise many bees will remain on the floor at the time, and be very troublesome. A cloth must be laid on the ground behind the hive to be removed ; nimbly lift the hive thereon, and gathering the four corners tight tie them fast on the top : immediately draw a string close round the body of the hive to prevent any bees crawling between." They must be conveyed in a gentle manner.

In regard to hives straw is the best material, " as protecting the bees the most perfectly in the extremes of cold and heat, and being also generally easiest to be procured. Where it is not so, rushes, wicker-work plastered over, or sedges, may be substituted in its stead. For this use, unthrashed straw should always be employed, of all kinds, of which that of rye is to be preferred, as thrashing shivers and makes it rough and shaggy, which the bees with much labour are obliged to gnaw off. They are made of different forms or shapes, but those in common use answer very well ; they should be neatly hooded over with an upper coating of straw.

The chief attention necessary in the management of bees is at the period of their swarming, when great care should be taken to secure them.

In estimating the profit of this sort of stock, it has been suggested that " one consideration should not be overlooked, viz. that almost the whole produce arising from the sale of both honey and wax is in a great measure clear profit ; as bees and bee-hives are equally free from rents and taxes ; and the culture of them does not



in the least injure or impede any other improvement in any respect. Nor do they require a constant attendance, as most other articles of improvement do: for a proper person might easily oversee, with a little assistance in swarming-time, at least five hundred bee hives. And has nature has amply supplied them with food, and with powers to provide it for themselves, they put their owners to little or no expense for that article; which cannot be said of any other of our servants whatever."

It is a circumstance that deserves notice, that by attention in the bee-master in the selection of food, almost any flavour or colour may be given to the honey, from the bright amber to a pale yellow. Mr. Paterson, of Castle-Huntley, in Scotland, found the flavour very delicate from *minionette*; it is the same from *rosemary*. *Bean-honey* is pale, and *heath-honey* brown, with much difference in flavour. In Norfolk they commonly suppose the honey debased by the great quantity of buck-wheat that is grown; but Mr Marshall suspects it to depend either wholly or in a great part on the heath.

*Fish-ponds.*— In particular situations, especially where the proprietor of the lands keep them under his own management, it may not only be convenient and agreeable, but likewise highly profitable, to have ponds for the breeding, rearing, and preserving of different sorts of fish. Where ponds for this use do not naturally prevail they may in many cases be readily formed, particularly where there are very gentle falls or valleys between hills, or other depressions taking place in the grounds; and through which waters pass with a slow or very easy current. The nature of the situation will show the extent of the ponds, and the number that can be readily formed. Where water and situation admit, two, or three, or more may be made on the same line or course, the head of one constituting the bottom of the other. And from one to four or five acres of ground may be covered with water, according to the supplies and other circumstances.

In such situations the only expense of forming convenient fish-ponds is that of constructing heads or banks across the valleys, or depressions, for the purpose of damming up the waters to the requisite heights, with proper sluices; which in most cases, especially where clay is at hand, may be done with but little expenditure of money. These banks or heads should be formed on foundations of sufficient depths, as from two to three or more feet, and in breadth proportioned to the extent and pressure of the water. The wall in the middle part, which should not be less than three or four feet in width, being wholly made by *puddling* pure clay, which in many instances may be chiefly procured by sloping out the ground intended for the ponds, or digging out small ponds for *stews*, &c. If clay can be easily got from other places, it is, however, better to let the ground for the ponds remain, as the fish feed better for it. As the work of *puddling* advances, earth must be well rammed to the different sides of the wall, and when finished, the whole immediately well covered over with it, in order to guard against cracking. In cases where the ground on the sides rises in a very gentle manner, banks or heads of from six to eight or nine feet in height will often



be capable of covering some acres of land with water. But in the contrary circumstances they will be required to be considerably higher, as well as of greater breadth and strength. This may be easily regulated by proper levelling:—supposing ten feet to be a sufficient height in the centre for raising the water, the foot of the bank should not be less than thirty-five, being gradually narrowed or sloped on the sides so as to bring it to eight or ten on the top. It is better, however, to have the side next to the water more sloped than the other. Some such proportion as this should be preserved in all cases, always giving them too much rather than too little breadth in their foundations. Proper grates, sluices, and diverting channels for taking off the water in the time of floods will likewise be necessary; the last being formed and conducted along the sides of the ponds, where there are more than one, and the sluices fixed in the lowest parts. These should be made perfectly strong, of good seasoned oak, and be well fixed in the banks, and the clay tightly rammed in about them.

The expense of constructing heads and banks of this nature, including every thing, may in most situations be estimated at from one to two shillings the cubical yard.

In raising carp it is often the practice to have three ponds: one for the purpose of spawning the fish in, and in which they should be left during the rest of the summer and the following winter, as they mostly spawn from the beginning of May to the latter end of July; another for the convenience of nursing up the young fry, into which they should be put about the latter end of March or the beginning of April, choosing a calm but not sunny day for the business. After which they should be carefully prevented from coming to the sides and being destroyed. In this pond they may remain two days, and become four, five, or six inches in length, and good for use; the third or main pond is destined for the reception of the grown fish, as those that measure a foot or more, including the heads and tails.

The proportions in which these different ponds are advised to be stocked are these:—for each acre of the first sort, “three or four male carps, and six or eight female ones.” The most suitable sort for this use being “those of five, six, or seven years old, in good health, with full scale, and fine full eyes, and a long body, without any blemish or wound.” The ponds should be previously cleared of all sorts of voracious fishes and other animals, as “perch, pike, eel, and trout; the water-beetle, and also the newts or lizards.” Such ponds as are warm and have an open exposure, with soft water, are the most proper for this use, all kinds of water-fowl being kept from them. For the nursing ponds a thousand or twelve hundred may not be more than sufficient for an acre, and for the main ponds, one to every square of fifteen feet is the proportion advised, as their growth depends greatly on the room and quantity of food that that is allowed. The best seasons for performing the business in this case are those of the spring and autumn. Some advise in these cases the stocking of carp or tench in the proportion of three to a square perch.



In first stocking large ponds or waters, as where they are of the extent of three or four acres, carp, in the proportion of three hundred to the acre are recommended ; but where they do not extend to such sizes, not so great a proportion. And in stocking, after two or three years, four hundred to the acre.

Where the ponds are suitable for tench, the first stocking with them in such cases may be rather more, and in the re-stockings considerably more, as seven or eight hundred to the acre.

As perch are great breeders, in first stocking with them six hundred to the acre may be sufficient. In Berkshire, where there are many ponds for the preserving of fish, they usually stock with carp or tench in the proportion of one hundred to the acre, the fish remaining four years in them. But in the management of Sir Harry Featherstone, in Sussex, in a pond of twenty acres reduced to sixteen by the deposition of mud, the stock is generally in the proportion of twelve hundred carp and an equal number of tench ; or at the rate of seventy-five brace to the acre. And in this proportion they are said to succeed well. Where pike does not form any part of the stock of ponds care should however always be taken not to overstock, as where these sorts of fish have not an abundant supply of food they never answer well. When taken from close-stocked ponds a larger proportion should likewise be employed than in other cases.

The waters of some ponds are better adapted to raising some sorts of fish than others. Thus, those where the water is rich and white are more adapted for carp : while such as have a thicker appearance, and where there is a greater deposition of muddy matter, are better suited to tench. Perch are capable of being raised in almost any sort of ponds. Eels succeed best where the ponds are not very large, but where fed by a spring, and there is a large portion of rich sediment. Pike should never be kept in ponds with carp or tench, but in separate breeding-ponds, where the supplies of small fry are considerable and not wanted for stores.

Carp, tench, and perch are the sorts principally cultivated with a view to profit, with a few eels occasionally. But perch and eels should not be admitted where the ponds are but thinly stocked, as they are great devourers of the young fish.

Carp and tench answer best together where the extents of the ponds are pretty large, as, in other cases, the former, from being a much more powerful fish, beats and deprives the latter of his food. Carp seldom afford much profit in ponds of less extent than half an acre ; but tench thrive well in those of almost any size, being often found good in ponds of only a few perches square. Carp, perch, and eels succeed well together ; and also tench and eels. Carp more frequently injure themselves by breeding than tench, though it sometimes happens with the latter. It is not improbable, but that in small ponds it may be the best practice to keep the carp and tench separate.

The produce or profit afforded by fish-ponds has not yet, perhaps, been sufficiently attended to in different situations to afford correct conclusions ; nor is it well ascertained what is the annual increase



in weight in fish of different kinds, in different periods of their growth, and under different circumstances of soil and water. Mr. Loveden states, that in Berkshire a pond of three acres and a half, drawn after being stocked three years with stores of one year old, produced

Of carp, 195lb. weight,

Of tench, 230 ditto,

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425, which sold for 20*l.* 10*s.* or nearly 2*l.* 6*s.* per acre per annum.







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